The Quarterly

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Publicity Work. The publication, in this and future issues, of copies of the press bulletins furnished the special correspondents of the Association for the use of local newspapers, is for the purpose of bringing the entire membership in close touch with this most timely and important work of the Association. For more than a dozen years the Association has devoted itself to the consideration of fire hazards and the compilation of standards calculated to instruct the common understanding on the subject of the fire waste. One might venture to say that there is hardly another public service to which has been given so much of valuable time and voluntary research by skilled and capable specialists and engineers. Year after year these standards have been discussed in the light of cumulative experience, and revised and amended under such discussion, until they now represent the most valuable and authoritative guides and data modern knowledge can produce.

While, however, we have through the past decade been painstakingly and laboriously compiling these standards, the observance of which we know would eliminate common hazards and hazardous conditions, the national ash-heap has been steadily augmenting; until to-day we find ourselves with the results of our unselfish labors in our hands, facing fire losses greater than those of all the world, and facing a public which is as yet almost wholly indifferent to them.

Realizing this, and that if its standards are ever fitly to serve the purpose for which they were made, the public must be educated to observe them, the Association last year began a campaign of publicity under the personal direction of President Goddard. Over sixty of our prominent members throughout the country volunteered to bring the matter of the fire waste before the editors of their local newspapers, and the preparation of bulletins similar to those reproduced in this issue of THE QUARTERLY was at once begun and has been continued throughout the year. Care is taken by our correspondents that duplicate matter shall not be furnished to different editors in any one city.

The response of the editors has been most gratifying. Many of them have made personal investigations of conditions in their own cities, publishing the results with forceful editorial comment. A number of our own members who are able writers have prepared special articles for the popular magazines,

View showing method of quenching panel after subjecting same to fire.

which were gladly accepted by the publishers as dealing with a matter of exceptional public interest. It would appear that the editors were quite cognizant of the enormous fire waste of the country and were only waiting for authentic facts and figures to begin a campaign of education on their own account as servants of the public welfare. At any rate the public attention now bestowed upon fire-prevention matters is so generous as to call forth the following editorial comment from an observant trade publication, Fire and Water Engineering:—

It is gratifying to note that the newspaper press quite generally is becoming conscious of the serious significance of our annual national fire loss. That editorial attention is being paid to the matter is evidenced by leading articles from several points, and these editorials are related in point of subject and in point of time in a way to suggest that some organized attempt is being made to get the fire loss problem before the people of this country as a whole. This concert in the matter may be traceable to the press bureau of the National Fire Protection Association. If it is so the bureau is doing a good work. The interests represented by this journal must have felt for a long time that before any marked progress could be made in keeping down losses by fire there must be forced to the popular understanding that there is a fire loss problem. The average layman at present believes, if he gives any thought to the matter whatsoever, that a certain number of fires and a certain percentage of fire loss is just as necessary a manifestation of Providence as our forefathers used to think of the epidemics of disease. That these great and devastating epidemics of sickness, which once carried off thousands, are preventable, and that they are now prevented because people, individually and collectively, give proper heed to sanitary rules governing in the matter, is pretty well understood. Comparable with the foregoing it is very probable that when citizens generally come to know that in Germany, France, Italy, Spain, Belgium, Holland, Switzerland and Great Britain the average annual fire loss per capita, the average rate paid for fire insurance, and the average annual loss of life by fire are each about one tenth of the corresponding averages in this country there will forthwith dawn upon the popular understanding that there is a fire problem in this country. Another instance which ought to appeal strongly to the popular understanding: Berlin has a population about one third larger than Chicago. It has grown during recent decades as rapidly as Chicago, and is quite as strenuous in its activities. It is surrounded by enormous and rapidly growing manufacturing sections. The annual fire loss of Chicago approximates $5,000,000. The annual fire loss of Berlin rarely exceeds $150,000. If these comparative figures were generally known it seems probable that a profound impression would be created on the popular understanding. To get such information before the people of this country is certainly a task worthy the prolonged and serious effort of any newspaper.

That the task referred to is recognized in its proper magnitude by the leading editors of the country is evidenced by the tone of many editorials, of which the following extracts from the Boston Herald in concluding comment upon a recent fire is an example.

There is terrific loss of life and limb in this country from preventable causes. No other land shows anything like it, or anything approaching it. This is not because of the vastness of our population, but because of its carelessness. We are the most careless people on earth. We permit a looseness of conditions, a recklessness of method, or a method of recklessness which would not be tolerated in Great Britain or Germany or France. This laxity runs on our railroads, pervades our coal mines, meanders in our mills, asserts itself in the slovenliness of our cities and our vacant lots, and is traced directly to our homes along the icy sidewalks to our front doors and the doors of our churches and public institutions. The average American cares no more about the conditions outside the walls of his home than he cares about the conditions on the most distant planet. We are indifferent and unashamed. The spasms of public horror are soon over and forgotten. They accomplish nothing.

Over fifty per cent of the fires in the United States are from easily

preventable causes. This being the case, would there seem to be a matter of any greater importance now before us than the education of the public through the publicity work so satisfactorily begun?

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The Spoken Word. The number of subjects which can be satisfactorily covered by fire-hazard bulletins is however necessarily limited. The common causes of fire may be counted upon the fingers, and yet the constant reiteration of facts and figures in relation to these causes is what is needed for awakening public responsibility. The furnishing of suitable matter to the newspapers of any city immediately following a local fire is a plan calculated to serve a good educational purpose, by supplying instructive information at the moment in which interest is stimulated;—perhaps by personal and financial loss.

But there is another department of our work of publicity to the development of which there are set no tactical limits, and this is education by means of the spoken word. In our membership throughout the nation are many capable speakers who are admirably equipped, by knowledge of the special conditions in their localities, to render distinguished service by addressing local and national public bodies, which bodies need only to be properly impressed with the importance of fire prevention to themselves become potent factors in checking the fire waste. The occasions of such public speaking are commonly matters of extended newspaper report, so that our members rendering such service are practically speaking to an entire community; and, in the large cities, to a large number of adjacent communities reading the metropolitan press.

This work of the association, which may come to be called the "speakers' bureau," to distinguish it from the "press bureau," is only now in its infancy, although a number of our members have on their personal initiative or by special invitation from other bodies already inaugurated the work which it is our hope to extend by systematic effort.

Immediately following the last annual meeting the Secretary, on invitation of the Texas Fire Prevention Association, attended and spoke at the ninth annual meeting of that organization held in San Antonio, Texas, where he met with a most cordial response from that unusually alert and able body of men. He has since spoken at a banquet of the Vermont Association of Local Fire Insurance Agents, and at a quarterly meeting of the Underwriters' Association of the Middle Department, at Philadelphia. Mr. F. M. Griswold of New York, chairman of the committee through whose efforts such gratifying progress has been made in the important work of standardizing hose-couplings and hydrant-fittings for public fire services, attended the annual convention of the International Association of Fire Engineers at Grand Rapids, Mich., and spoke upon the subject of co-operation between organized fire departments and the National Fire Protection Association; which address has had wide publicity. Mr. George E. Bruen of New York also attended this convention and delivered an address upon fire prevention, outlining the organized work already done in that direction. Mr. Edward T. Campbell of St. Louis attended the Trans-

Mississippi Congress in Denver, speaking of the duty of educating people in the fire hazard and quoting carefully prepared statistics of the fire-waste. Mr. J. M. De Camp of Cincinnati spoke forcibly at the convention of the Michigan Association of Fire Insurance Agents at Lansing on "Publicity and Education;" and Mr. Powell Evans, of Philadelphia, appeared at the annual meeting of the Underwriters' Association of the Northwest and presented a most convincing paper on fire prevention as related to credit.

These various addresses, with the accompanying publicity they severally received, are an indication of the powerful educative result that may reasonably be expected to follow a regularly-planned speaking campaign conducted by the Association, with the help of members willing to render this special service. There is not a commercial club, board of trade, public library, fire department, or any other city organization whose function is to serve the public good, which might not respond to our efforts and co-operate in the promulgation of our standards, once the character of our work is brought clearly before it. In this every member may assist, and the co-operation of all is solicited in furthering such educational work on all occasions which may be presented. Few places are so remote as to be inaccessible to some one of our speakers at some period of the year, and if members who can arrange for local speaking will address the secretary far enough in advance to make proper preparation possible he will do his best to make the engagement desired.

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Other Work of the Association. The above radical and necessary extension of the activities of the Association does not mean that our regular technical work will be in any manner neglected, or that the Association will not keep abreast of all developing sciences and industries affecting the fire hazard. Much of our committee work has been completed, and the committees released from responsibility; but all subjects which, by their nature, cannot be finally disposed of, but present developing aspects, are in the hands of competent continuing committees. New committees will, as heretofore, be appointed as needed to handle matters not falling logically to committees now standing, as, for example, the new committee on High Pressure Fire Service Systems, whose function it will be to keep track of the extension and development of such systems, and the apparatus used in connection therewith.

Aside from the preparation of standards the statistical work of the Association in the compilation and publication of the *fire record* is one of increasing value, and members are urged to familiarize themselves with it. The following extract from an unsolicited letter, written by one of our most influential members, indicates the value of these tables to such as are familiar with the purpose of them:—

> I have just had occasion to refer to Volume 2 of the QUARTERLY, pages 533 to 538, being classification of sprinkler fires by "classes of occupancy," and by "reasons for failure." I think these two tables taken in conjunction are the most interesting fire prevention statistics I have ever seen, and among the most valuable. From them the student can learn how best to reduce the opportunities of sprinkler failure, and where best to direct his attention.

This is from one who is especially interested in the reliability and efficiency of automatic sprinkler systems, but it is not difficult to foretell the time when the public itself, or its officials charged with the responsibility of investigating and checking the fire waste, may turn to our tables of fire causes as the only existing available statistical data from which accurate conclusions can be drawn, or upon which intelligent official action may be based. In fact, this particular feature of our work may alone one day justify our many years of cumulative effort in building up the organization of the Association.

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Electrolysis. Through the courtesy of the Franklin Institute, Philadelphia, we are able this month to add to our printed papers an unusually lucid and well illustrated paper on a subject not hitherto presented: the electrolytic deterioration of water pipes from the return currents of trolley roads. Mr. Knudson's conclusions coincide with those of the experts who have from time to time been called for testimony in suits of water companies against electric railway companies, that there is no known method of protecting a water distributing system of pipes and mains from the electric currents of single trolley railways. The St. Paul water commissioners, as a result of a recent investigation of conditions in that city, conclude that the water mains are in considerable danger. The expert report recalls the suit brought several years ago by the city against the street railway company for $500,000 alleged damages to the water mains from electrolysis. The suit never came to trial, but the street railway company promised to remedy the trouble by putting in heavier rails and stronger leads to return the current to the power houses. This has been done to some extent, the report says, but the trouble has not been effectively remedied. Similar conditions in Peoria, Ill., have resulted in a suit which has been hanging fire for over ten years. An exchange commenting upon the Peoria case, says:—

> One of the notable facts in the case is the statement by the judge that there has been no advance in the art of taking care of such stray currents and that such improvements as have been made in the methods of returning current to the dynamo by underground routes have not kept pace with the increase in the street car system, so that the water pipes are in certain districts even more subject to damage than when the suit was begun. Some of the engineers called by the former judge refused to testify because of the injury their testimony might do to their business.
>
> All these things indicate that the delay is due, not to undue influence of any sort, but rather to the reluctance of the court to make a decision upon a case in which the engineers are at a loss to supply the necessary technical advice, aside from the "entire removal of electric currents from the water mains, which is impossible as long as the return currents of the electric railways are grounded or in electrical contact with the earth."

The conclusion does not seem to be unwarranted that in a considerable number of the smaller cities of the country in which single trolley railways have been operated for ten or fifteen years, there may be weak spots in the water mains due to electrolytic action which any unusual water pressure prolonged during a stubborn fire might rupture, with disastrous consequences.

Drug Houses Fire Record. The fire record of drug houses tabulated this month, while covering reports of but 131 fires in this class, is yet of much instructive interest. It is manifest that in buildings in which chemicals and liquids giving off inflammable vapors at ordinary temperatures are stored, the use of matches, lamps, tapers, open gas flames, and ordinary lanterns should be prohibited. While but about 11 per cent of the fires listed are charged directly to the lighting hazard, the 15 per cent charged to inflammable vapors under special-hazard causes may be in large proportion also fairly charged to the lack of proper lighting facilities. The lighting of all such properties should be by carefully installed electric systems, there being no switches nor key sockets in rooms where inflammable vapors may be liberated. Where electric light is not available such rooms should be entered by daylight only.

Publicity Bureau Bulletins.

NOTE.—By recommendation of the Executive Committee that the general membership be brought in touch with the Publicity work of the Association there are printed below sample bulletins which have been transmitted to N. F. P. A. correspondents for publication in local newspapers. Members and correspondents are at liberty to quote from these articles, or reprint the same entire, without reference to the QUARTERLY.—EDITOR.

Bulletin No. 1. Our National Folly.

The rumor abroad in the financial world that several of the principal foreign fire insurance companies are about to reinsure their lines preparatory to retiring from the field of American underwriting, may, if true, bring us to a realization of our stupendous national folly. The average annual fire waste of the United States for the five years ending with 1907 was $252,000,000, and the losses for the year 1908 beginning with $24,000,000 in January, and steadily increasing, aggregate over $200,000,000. Although there were but seven fires during the year just ended where the losses were $1,000,000 or more, the aggregate loss equals that of the year of the great Baltimore conflagration. When the business man of large interests faces a restriction of his credit due to the fact that he can no longer obtain sufficient fire insurance to cover his combustible holdings, the fact that we have been burning up $500 worth of property every minute, day and night, for the past six years, may at last penetrate his consciousness.

What if we were to lose a quarter of a billion dollars every year in wheat, or cotton or beef? What if such a value in shipping should sink in New York harbor? What if the national treasury should be looted annually of that amount or business failures approximate that figure?

The San Francisco calamity forced several insurance companies out of business. In the last fifty years one thousand insurance companies in the

United States, or more than three times the number of existing companies, have been forced to withdraw. In the last ten-year period the insurance business suffered an underwriting loss of four and a half per cent, or over $86,000,000. Who will continue to supply responsible capital indefinitely for the national ash heap? The average American in his reckless individualism has assumed no responsibility for the fire waste, leaving it to the insurance companies to refill their purses by increased premium rates.

State legislatures have made frequent efforts to prevent the advance in insurance rates by various legislative enactments, but legislation cannot prevent rates being sufficient to pay losses without seriously reducing the ability of their constituents to obtain necessary insurance. Any legislation which will reduce the annual fire loss will, at the same time, reduce the average insurance rate. Unless this annual fire loss is reduced, it may soon transpire that capital will withdraw from the business of underwriting without the spur of unfriendly legislation; the losses alone, and the national indifference to them being quite sufficient an incentive.

A fire in the congested portion of New York City covering an area as large as that of San Francisco would put every fire insurance company in the country out of business. It is well recognized that the Chelsea conflagration may be duplicated any day; there is scarcely a city in the country which does not offer the conditions for such a fire. Meanwhile what is the good citizen doing? It has not yet dawned upon him that he can do anything.

A man in Boston, who recently turned two Back Bay houses into one by cutting doorways in the party-wall, protested against the recently adopted city building law which required him to install tinclad fire doors as a fire stop. He gravely declared that a fire was no more likely to start in one house than in the other!

The declaration of experts that over fifty per cent of the present fire waste of the country is from easily preventable causes indicates that the entire nation might well be taught lessons in individual responsibility. Correction of careless habits is certainly possible in both grown-ups and children. Many of our national sins can, however, only be corrected by collective action. It is too much to expect that our people, in their impetuous haste and rush, will, in the very near future, cease to erect the inflammable shells they now put up and fill with equally inflammable contents. We differ from the Europeans in solidity of character; and our character is reflected in our architecture; but we can at least make reasonable laws to protect us from the carelessness of one another without going to the extent of the French statutes, which makes a property owner liable for damage if a fire spreads beyond his premises.

Unfortunately no sense of the immorality of needless waste has yet moved us. Superinduced by the mental habit of considering our national supply of raw materials inexhaustible, is the thought that fires do not matter so long as there is insurance capital to pay for them. As we are beginning, however, to conserve our forests we may come to consider that the things our hands have builded may be also worth saving.

We may come to look with disfavor upon buildings of great areas without fire cutoffs, with huge floor openings, with unprotected windows. We may come to demand that our fireproof buildings shall be really fireproof, knowing that steel-work improperly insulated will buckle in a hot fire, even if it does not collapse. In the rush into concrete building now evident we may demand honest mixtures of cement, and the use of sand sharp enough to bind it, instead of the water-worn pebbles which will aid the crumbling process. We may cease our folly in making floor ten inches thick and enclosing stairs and elevators in a wall of equal thickness to prevent the spread of fire from floor to floor—and leaving our only window protection to one-eighth inch window glass, when strong and serviceable wired glass held in metal frames is available.

But who is to lead us into thus looking after our created property resources? There was organized some years ago the National Fire Protection Association. It has done much good work. By the public-spirited action of the men composing it tests of devices and materials have been made at its laboratories in Chicago and the results published for free distribution. These reports should be of vital interest to every architect and builder, but few of either profession know of their importance and value. Architects make plans for elaborate and deadly fire traps, and builders faithfully execute these plans in cheap and shoddy material.

Ignorance of the law does not save a man in court. How long will ignorance of fire protection and prevention continue to exonerate conflagration-breeders before the bar of public opinion?

Bulletin No. 2. The Menace of the Match.

The eighty million people in America use as many matches as the eight hundred million in the rest of the world, according to the statistics of the National Fire Protection Association. This is a startling commentary upon the American nation, and supports the contention that we are the most wasteful and extravagant people in the world.

If one is in need of a match anywhere in continental Europe he must seek it in its proper place. Matches are not wasted in the Old World. Centuries of training in thrift and economy make the continentals conscious of the fact that matches cost money. Where does one find them in America? They are in almost every room, in almost every building, public and private. The American breathes imprecations if he cannot at any moment of the day or night reach out his hand and find a match. They repose in the pockets or linings of every old coat and waistcoat; they are scattered about desk and bureau drawers; they are found in every accumulation of rubbish wherever it may be; they are so carelessly and recklessly thrown about that rats and mice have adopted them as a standard article for nest building, certain always of an available supply.

Unfortunately the burden of this extravagance is not confined to the cost of the matches themselves. This little article, unknown until 1832, while perhaps the most important factor in our civilization, has been doing

its best ever since its creation to destroy the world it was designed to serve. The assistance given it as an instrument of destruction by the carelessness of the American people is a matter of amazement to continental countries. The average *per capita* property loss by fire in Central, Western and Southern Europe is 33 cents; in the United States the average is $3.02. The reason for this astonishing difference is obvious the moment conditions are scrutinized. While this is being written a continual shower of imperfectly extinguished matches is falling into waste baskets, rubbish heaps, upon the rugs of clubs, hotels, dwellings and offices, thrown by careless smokers. Men reputed to be good fathers have been known to light cigars in the hallway of their homes, throw the match in the general direction of a cuspidor and go out; to return in half an hour to see firemen rescuing their sleeping children from second-story windows.

In Massachusetts, in 1907, there were 5,794 fires, 1,230 of which, entailing a loss of $658,346, were caused by matches.

The fire marshal of Wisconsin says, that during a period of sixty days, twenty-five fires in his state, involving a property loss of $106,327, were traceable directly to the "parlor" match. In Ohio, another of the few states giving attention to needless fire waste, the fire marshal declares that match fires constitute a "continuous performance" at a cost of half a million dollars per year. In one year of 446 fires from matches in this state, 122 were caused by children; 298 by the carelessness of adults, and 26 by rats and mice—also through carelessness of adults.

Thirty-six women and children were burned to death in Ohio through having their clothing fired by matches. Of these, who suffered death in this, its most horrible form, thirty were children playing with matches left carelessly within their reach, and six were women whose clothing took fire from flying match heads. Among these are not included five mothers who were themselves burned to death while trying to save the lives of their burning children.

The number of persons burned to death in the United States each year by the parlor match is between eight and nine hundred, and the property loss more than $2,000,000. The "parlor" match is the common variety, which can be ignited upon any hard surface, as distinguished from the "safety" match, which cannot ordinarily be ignited except upon the box in which it is sold. The original "lucifer" match, which, when ignited, gives off the choking fumes of sulphur, is still used extensively, and is a safer match when handled carelessly than the larger headed parlor type.

Certain effort has been expended upon the parlor match to lessen its fire hazard. In some varieties the stick is chemically treated, so that a live coal will not remain when the flame is extinguished. In others, called "bird's-eye" matches, only a small white point of phosphorus on the head can be ignited by friction. These improvements are good so far as they go, but vast quantities of the most hazardous type are found everywhere in the United States. Denmark and Switzerland prohibit their use, and other continental countries impose restrictions. It is in America only,

where cheap wooden buildings abound, and where, therefore, restrictions are most vitally needed, that the parlor match is free to slay and burn.

It costs no more to make the safety match than it does to make the deadly variety, and it is ordinarily sold as cheaply. Modern matchmaking machinery can turn out from four to seven million of either kind in a day. It rests, therefore, with the people themselves, either to continue the present careless snapping of match heads upon bed covers, curtains, carpets, clothing and other inflammable materials, for which practice so frightful a price is paid in property and life; or to protect the common interests of humanity and the life of their households, by thoughtfully exercising care in ordering their match supply. It is almost wholly a matter of education.

If the facts and statistics of the American fire waste, and the relation of the parlor match thereto, could be brought clearly to the attention of the American people, it is impossible to believe that our laws would long permit the manufacture and sale of so great a menace to our common safety.

(These bulletins as furnished to special correspondents are in the form of galley proofs.)

Experimental Fire Tests.

Methods Employed at the Underwriters' Laboratories for Determining the Effect of Fire on Structural Materials.

By William C. Robinson,

Chief Engineer, Underwriters' Laboratories, Chicago.

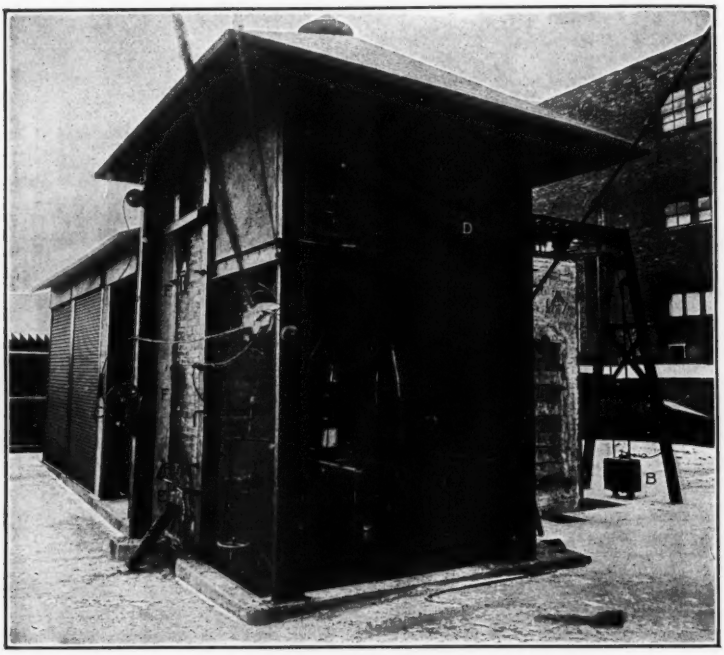
The object of the tests of structural materials conducted at the plant of the Underwriters' Laboratories, Inc., at Chicago, is primarily to determine the fire-retardant qualities, although, for purposes of comparison, it is usually necessary to obtain reliable information relative to structural values. Briefly stated, the method employed is to subject the device or material to fire of sufficient intensity and for a period long enough clearly to indicate the ultimate fire resistive point, the test conditions being selected to approximate, as far as possible, the more extreme exposures to which the device or material may be subject under conditions in actual service. A stream of water is applied to the test sample at the conclusion of the fire test, unless the sample is in such a weakened or damaged condition that this would serve no good purpose. The object of applying the water is to ascertain the effect of rapid cooling and the impact of fire streams.

The devices and materials thus far tested include materials used for fireproof partitions, proprietary building materials, building material in the form of brick, heat-insulating coverings for cold storage warehouses, asbestos wood, plaster boards, plaster blocks, post caps, wall and joist hangers, roof coverings, wired glass, metallic fire doors, metal clad and composition fire doors, metallic windows for wired glass, fire-retardant paints, fire door hardware, etc.

The tests are made in furnaces of various types designed and constructed to meet the special requirements of each class of work. Gas was selected as a fuel in order that the test conditions could be made as nearly constant and uniform as possible, and in order that the results of the tests of similar devices or materials would be comparable and relative values obtained.

Furnace No. 1.

The furnace shown in illustration No. 1 is designed for testing partitions, fire doors, wired glass windows and devices which are mounted vertically. It has also been found to be suitable for testing building materials which can be laid in the form of a wall, and which it is desired to expose on one side only.



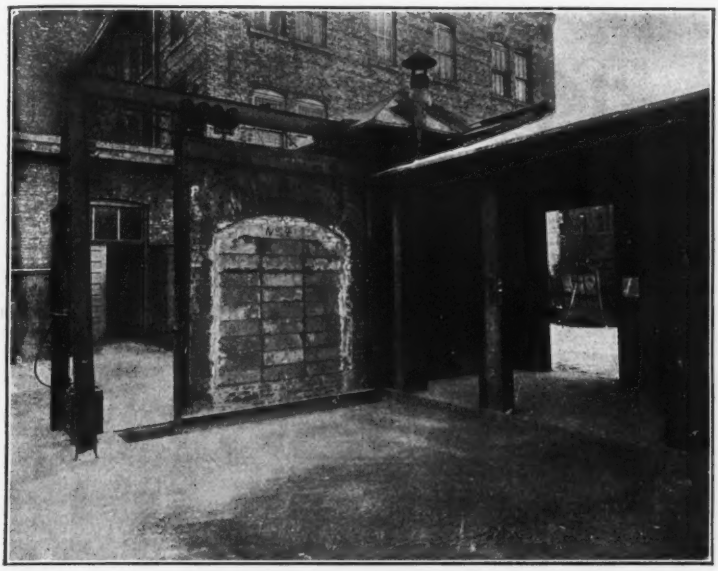
No. 1. Rear View of Furnace No. 1.

Showing apparatus for regulation and test panel (A) in position for quenching.

The apparatus consists essentially of a gas furnace with its front closed by a movable brick wall, in which the sample to be tested is mounted. If the test sample is a building material, as shown in the illustration, a panel of it is built into an opening in the wall. If the test sample is a fire door or wired glass window, it is mounted so as to protect a standard opening, five feet wide by seven feet high in the same manner as it would be in a building.

The movable wall of the furnace is mounted in a steel frame suspended by trolleys from an I beam supported at one end by the frame work of the furnace and at the other end by an "A" frame of channel iron. The wall is made movable so that the hose stream may be applied to the side of the test sample which has been exposed to the fire. It is pulled out from the front of the furnace by a counterweight suspended on the "A" frame, when a catch holding it in place is released.

The furnace proper consists of a shallow combustion chamber enclosed by a solid fixed wall at the back and one end, a small movable wall



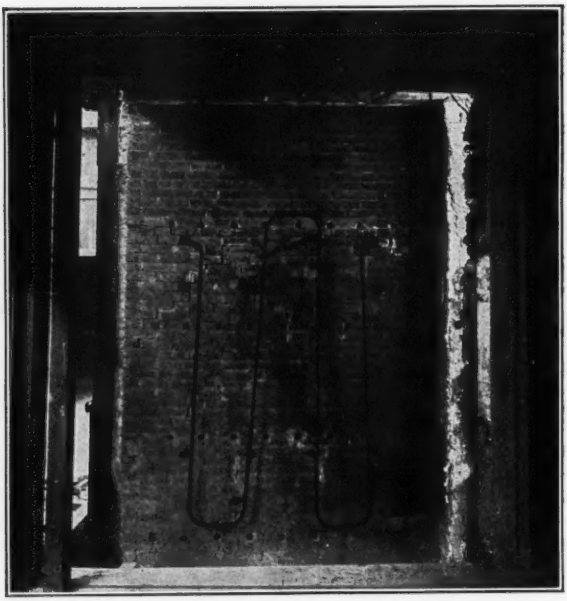
No. 2. Front View of Furnace No. 1.

Showing test panel built in movable wall, fire chamber, and observation chamber with part of sides raised.

at the other end and the larger movable wall just described. The end walls are provided with peep holes glazed with mica. Vent holes are provided in the top.

The burners are located in the bottom of the combustion chamber and with the air inlets are admitted through the back wall of the furnace. The action of the furnace may be described as follows: Illuminating gas from the city mains and air from a motor-driven blower are admitted to the burners and sufficient secondary air added to the combustion-chamber by means of numerous inlets in the back of the furnace to complete combustion and obtain the desired distribution of fire over the surface of the test sample. All of the air is supplied from the same blower, which, with the air ducts and regulating mechanism, is shown in illustration No. 1.

The furnace temperatures are measured by means of a water pyrometer, consisting of two loops of copper pipe suspended in the combustion chamber, two thermometers for indicating the temperature of the water as it enters and leaves the coil, and devices for insuring a constant flow of water through the coil. The difference between the temperature of the water as it enters and leaves the coil indicates the average temperature in the combustion chamber, the device having been calibrated against a number of thermo couples distributed in the plane of the copper piping.



No. 3. Front View of Furnace No. 1 with Panel Removed.
Showing secondary air inlets and water pyrometer.

An observation chamber is erected outside of and in front of the test sample when in position in the furnace. The sides of this chamber are composed largely of steel rolling shutters, some of which are shown in the raised position in the illustrations.

The amount of heat transmitted through the test samples is roughly indicated by means of thermometers placed on the unexposed side of the test sample; by means of thermometers placed at each side of the observation chamber, and by means of strips of cotton cloth and burlap suspended eighteen and thirty-six inches back of the test sample; the latter means being employed in the tests of fire doors and wired glass windows.

At the conclusion of the fire test, and after the sample has been run out from the furnace, a $\frac{7}{8}$-inch stream of water is applied to the side which was exposed to the fire, the water pressure at base of the nozzle being 50 to 60 pounds. The tip of the nozzle is located twenty feet from the test sample and the stream applied from one to five minutes. The application of such a stream is illustrated. (See frontispiece.)

The nozzle pressure and duration of the stream are varied for the different classes of materials tested.

The duration of the tests made in this furnace vary from one to two hours and the temperatures from 1500 to about 2000 degrees Fahrenheit,

depending on the class of service for which the device or material tested is designed. Higher temperatures for longer duration can be obtained, if desirable.

Partitions, in which inflammable materials are incorporated, or which are not designed to withstand severe fire conditions for long periods, are tested for one hour under temperatures rising as high as 1700 degrees Fahrenheit. Partitions for which higher fire-retardant values are claimed are tested for two hours at temperatures rising as high as as 2000 degrees. Building blocks and materials are also tested under the latter conditions. Fire doors are tested for one hour under temperatures as high as 2000 degrees. Wired glass windows are also tested for one hour, but the temperatures are somewhat lower, varying from 1500 to 1600 degrees on account of the comparatively low melting point of the glass.

In the tests of partitions and building materials care is taken to properly restrain the test sample at all edges, so that the effect of expansion may be carefully noted. To accomplish this the steel frame carrying the moving wall of the furnace is made very heavy, and designed so as to resist the pressure exerted by expansion in the samples tested. This pressure is received directly by the steel frame, the brick work at the borders serving to insulate and protect the steel from the furnace heat.

Deflections in the test samples are measured from taut reference-wires stretched across the back of the steel frame carrying the movable wall, the measurements being made at five-minute intervals, and from over thirty points.

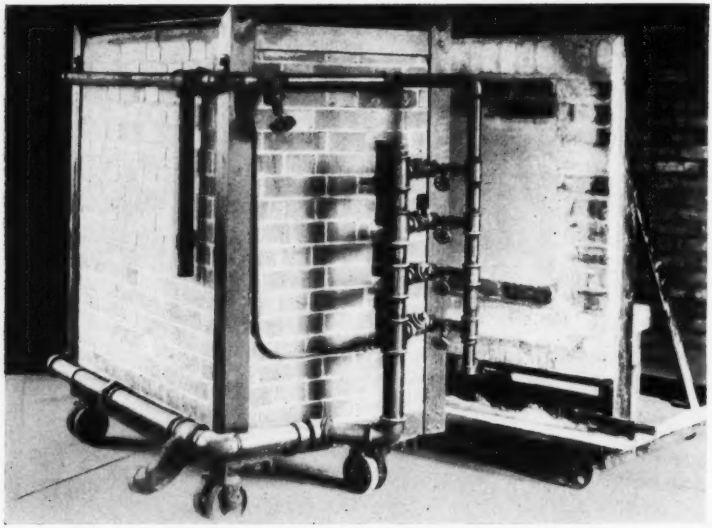
Partitions and panels of building material are erected in separate steel frames, and installed in the test furnace after the requisite period of seasoning. Sufficient restraint is furnished by the brick wall mounted in the steel frame in the case of tests of wired glass windows and devices of this class mounted in the wall.

The Geological Survey of the United States Government has used this furnace for the fire tests of a considerable number of building materials, mounting the various materials in the form of panels. Illustrations Nos. 1, 2 and 3 are taken from Bulletin 370 of the Geological Survey, to which readers of the QUARTERLY are referred for information regarding the behavior of the various materials tested.

Furnace No. 2.

The furnace shown in No. 4 is designed to meet the requirements of a closer regulation of temperatures than can be obtained with the furnace just described, and is for use in testing materials in the form of blocks or bricks where large test samples are not required.

The furnace is of the radiation type, although the test sample undoubtedly receives considerable direct heat. It consists of a brick chamber thirty-three inches wide, thirty inches high and twenty-two inches deep, arched over at the top with fire brick. As in the case of the larger furnace, one side is closed by a movable wall in which the test sample is mounted. The movable wall is supported by a frame and carriage made of steel angles, and provided with wheels, so that it can be rolled away from the furnace.



No. 4. Furnace No. 2.

Showing test panel in front partially removed. Gas and air supply disconnected.

Four blast burners are introduced through each end, and directed toward the back wall at an angle of about 45 degrees. They are supplied with gas directly from the city mains, and with air by a small motor-driven blower. The back wall of the furnace is heated up first, and as each burner is controlled individually, it is possible to regulate the heat so that any predetermined temperature gradient can be maintained within three per cent variation at any point. It is possible to subject the test sample to an intense even heat without any direct flame impact, and to reproduce any given condition very accurately. The temperatures are measured by means of thermo couples introduced through holes in the end walls, and placed close to the face of the test sample. The maximum temperature attainable at the sample is about 2200 degrees Fahrenheit.

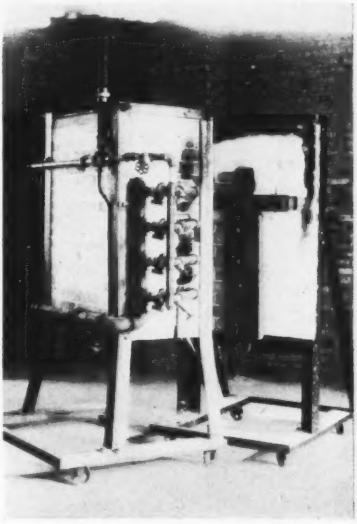
The furnace accommodates a panel made up of twenty-one bricks, with a margin at each edge, and was originally designed for testing this material. It has been found very convenient in making experimental tests on other building material in the form of blocks, particularly those of hollow construction. The furnace proper is also mounted on wheels, so that the whole apparatus can be moved about, and used at any point convenient to gas and electricity. It is used indoors at the laboratories.

The samples are quenched with water at the conclusion of the fire test in much the same manner as in the tests already noted, the movable wall being rolled away from the furnace by hand.

The tests made with this furnace are usually of ninety minutes duration, the temperature increasing gradually to 1700 degrees in thirty minutes, and continuing at this point for the following sixty minutes. Shorter tests with modified temperatures are often made to determine the point at which certain damage occurs.

Furnace No. 3.

A modified form of the furnace used for testing brick is employed in testing fire-door hardware and devices of this character. This furnace is shown in No. 5. It differs from the apparatus just described mainly in that the furnace proper is moved instead of the part carrying the test



No. 5. Furnace No. 3.
Showing furnace partly removed and fire-door hanger mounted for test. Air supply disconnected.

sample. This is made necessary by the fact that the test sample supports a load, and cannot be moved while in a heated condition.

Modifications are made in the form of the burners, and the furnace is mounted about three feet above the floor to provide room underneath for the weights attached to the devices tested. The illustration shows the apparatus with a fire door hanger mounted for tests on a short section of fire door track bolted to the front wall closing the furnace. The track and hanger are mounted as in practice, the hanger being bolted to a cast iron weight of the same thickness as a standard fire door. Additional weights are attached to this cast iron piece until the load on the hanger equals the maximum allowable. The temperature is gradually increased

until a certain maximum is reached, after which the furnace proper is rolled away, and a stream of water is applied to the heated sample. The temperatures are measured by means of thermo couples placed closed to the test sample.

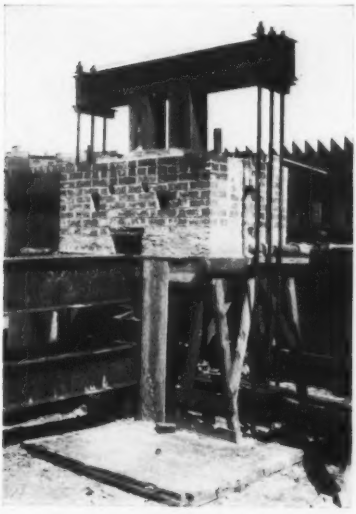
Furnace No. 4.

The apparatus used in testing post caps, wall hangers and joist hangers is shown in Nos. 6 and 7. It is made up of two parts, the loading mechanism and the furnace for supplying the heat. The apparatus for applying the load consists of two 15-inch I beams, which form a lever about 30 feet long, supported on a 2-inch bearing-pin located near the inner end.

No. 6. Furnace No. 4.
Showing loading mechanism, with post cap in position for test.

A similar bearing-pin and block is placed on top of the lever at the extreme inner end. Upon this upper bearing-block a strut is mounted, carrying the device to be tested. The device itself carries two struts bearing against the upper I beams of a framework designed to provide the necessary reaction in the system. This framework is so mounted that the thrust remains normal to the bearing surface of the device tested. The load is obtained by placing the necessary weights at the outer end of the lever.

The furnace consists of a brick chamber enclosing the test sample, and is mounted on a platform which is supported independently of the moving parts of the system. A blast burner is introduced through each end wall of the furnace so as to cause the flame to impinge on the test sample.



No. 7. Furnace No. 4.

Showing brick chamber enclosing test sample.

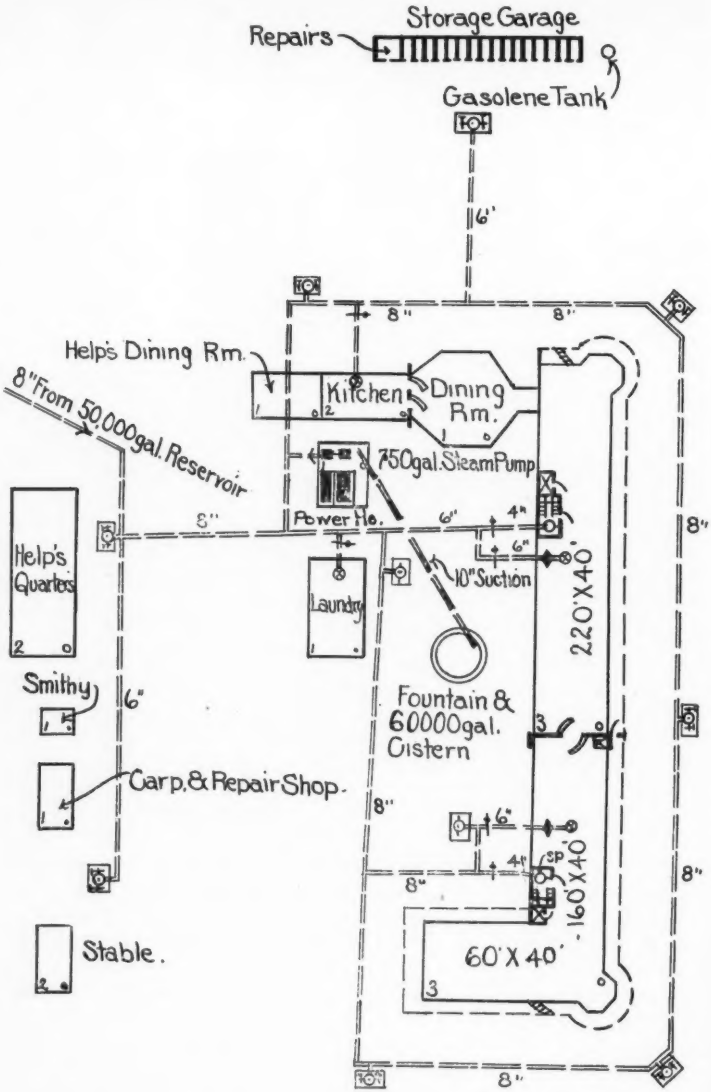
Gas is applied directly from the city mains, and air from a small motor-driven blower. Temperatures are obtained by means of thermo couples placed close to the test sample.

Reference marks established on the long arm of the lever outside of the furnace afford means of determining the deflection in the sample. Observation holes on all sides are provided for observing the condition of the sample throughout the test.

In the tests of devices of this character heat is applied until a certain maximum temperature is reached unless failure occurs. The walls of the test furnace are then pulled down, and a stream of water applied directly to the heated sample, further deflections being carefully noted.

Modifications of, or alterations in, the above furnaces, provide means for conducting fire tests of roof coverings, wired glass, paints and putties. The methods employed in the tests of these materials are varied to suit the requirements for each particular case, the tests being of proper severity to indicate the point of failure.

Tests of devices and materials used in building construction have thus far been confined for the most part to the above subjects. Test furnaces are now being designed, and methods perfected to ascertain the fire-retardant value of the various systems of floor construction, and column and beam protection.



IDEAL GROUND PLAN
For a
SUMMER HOTEL
Scale 1" = 100'
G. D.

Hazards and Protection of Summer Hotels.

By Gorham Dana,

Manager, Underwriters' Bureau of New England.

A paper on Season Hotels, delivered before the Eleventh Annual Meeting of the National Fire Protection Association, by Mr. H. L. Hiscock, gave an excellent description of this interesting class of properties. It is believed, however, that a somewhat more detailed discussion of the fire hazards and fire protection features may be of value.

The summer hotel, as found in New England, covers a large range of properties, including almost everything from a small camp to a palatial structure accommodating 500 or 600 guests, and 200 or 300 employees. It is difficult sometimes to draw the line between a hotel and a "boarding house," but, as a general rule, any hostelry containing an office and 30 guest rooms or more may be classed as a hotel.

Some of the larger hotels are essentially towns in themselves, including as they do all the processes and hazards of a small village. There is, however, one important difference; in the summer hotel the bulk of the value is concentrated in one large building, and a fire starting in any one part is quite apt to destroy the whole; while in the village the value is distributed and the chance for total destruction is less. Then again, season hotels are generally high structures of very combustible construction, arranged in a manner that favors the rapid spread of fire, so that the chance of loss of life is greater than in almost any other class of buildings.

The construction is almost always of wood and of the lightest and flimsiest character. Only in late years in such New England houses as the Mt. Washington and Poland Springs House has any attention been given to improved construction and protection. As a result, the average summer hotel is a veritable fire trap and very difficult to save when once on fire. That more lives have not been lost in such fires is due more to good luck than to any foresight on the part of the builders.

With the comparative cheapening of fire-resistive construction, and the gradual awakening of the public to the need of reducing the annual fire waste, it would seem that the time was about ripe for decided improvements in the construction and protection of this class of property. If, for instance, guests all realized that they were sleeping in a frame building, where the unfinished basement was used for the storage of empty boxes and barrels, an embryo carpenter shop and machine shop, a badly arranged gasolene generator, and a heating furnace, they would, if they were wise, leave the next day and not return until conditions had been improved.

Yet these are the exact conditions found recently in a high-class hotel by the writer. If the public once becomes aroused to the danger of present conditions, improvements will have to follow.

The need of improvements is most forcibly brought out by statistics.* There are probably about 1,000 summer hotels in New England. The losses during the last eleven years have been $2,763,640, or about $250,000 a year. The number of hotels destroyed was 140, or an average of nearly 13 a year.

The total amount paid by the insurance companies was $1,702,683, or about $154,780 a year. From this, it seems probable that the average hotel was only insured to a little over half its value.

These losses arranged by months and causes are as follows:

Losses by Months.

October	19	14 per cent.
May	18	13 " "
November	18	13 " "
August	15	11 " "
June	14	10 " "
September	14	10 " "
July	13	9 " "
April	11	8 " "
January	6	4 " "
December	5	4 " "
March	5	4 " "
February	2	1 " "
	140	

Losses by Causes.

Chimney	40	29 per cent.
Incendiary	29	21 " "
Unknown	26	19 " "
Exposure	19	13 " "
Misc.: Lighting, smoking, fireworks, tar or fat	6	4 " "
Electricity	5	3 " "
Workmen	5	3 " "
Furnaces or stoves	4	3 " "
Lamps and lanterns	3	2 " "
Forest and wood fires	3	2 " "
	140	

The ideal summer hotel, from the point of view of safety, is one built entirely of fire-resisting construction, with all floor openings shut off; with power plant, kitchen, laundry and all other hazardous portions located in detached or cut-off sections; and with inside protection as specified below. Such a hotel would be expensive, especially in localities remote from cheap transportation facilities, but in most cases it would be ultimately economical.

In a hotel of frame construction, however, it is possible to make improvements that will render it comparatively safe at a cost that is not prohibitive, and these improvements will be discussed under the headings, Construction, Arrangement of Hazards, Fire Protection and Management.

Construction.

Floor Openings. Probably the worst feature in hotel construction is unprotected stairways, elevators, chutes, wire-ways and other floor openings. If all these openings can be properly enclosed, draughts from floor to floor will be prevented and fire cannot spread rapidly through the structure. This will allow time for guests to escape and for the fire to be successfully fought with hose streams and chemicals.

*These statistics were compiled by Mr. H. L. Hiscock, Special Agent of the Aetna Insurance Company, Boston.

The best arrangement is to locate stairs and elevators in a brick well with fire doors at each floor. When this is not practicable, terra cotta, metal lath, and plaster, or even ordinary lath and plaster enclosures, may be made quite effective if good self-closing doors are placed at the openings. Wired glass may be used in these enclosures where light is needed, but ordinary glass should never be allowed. The doors may be of stamped metal or any of the numerous special patterns approved for corridor or partition use. Elevators can be readily enclosed without undue expense or disfigurement. The shaft should be of brick or other non-combustible material extending above the roof. All chutes, pipe-ways and wire-ways should be of metal or other non-conbustible material with substantial doors of similar material at all the necessary openings. It is well, where possible, to locate such conduits in the stair towers.

Fire Stops in Sheathing. Perhaps the next most important matter under the head of construction is the "stopping off" of concealed spaces in sheathing. This applies particularly to the hollow spaces between the wall studs which often communicate from floor to floor so that a fire once entering this space can travel as in a flue the whole height of the structure without being seen. It is an easy and inexpensive matter to put in five or six inches of broken brick or stone and mortar between each stud at the floor level and effectually prevent the spread of fire in this direction. All horizontal joist channels should also be "stopped off" at each partition, so that if a fire works into the ceiling it cannot spread between joists to the next room. Lathing should be fastened direct to joists and not to furring, for with the latter arrangement fire can readily spread in a direction at right angles to the joists.

Metal Lathing. Metal lathing is much safer than wooden lathing, not only on account of the absence of so much combustible material, but also because the better bond between the plaster and the lathing makes it more durable. Cement and lime plaster is much harder and a better fire retardant than lime and hair plaster. Metal lathing and hard plaster is recommended for all parts of the structure, but especially in the kitchen, laundry, and other hazardous places. A very desirable ceiling for such places is plank and timber construction covered with metal lath and plaster without concealed spaces.

Chimneys and Flues. Chimneys and flues are a most prolific cause of hotel fires. These should always be built from the ground up and should never rest on woodwork. The details of proper construction are too well known to need discussion here, but great care should be taken in supervising this part of the structure. All chimneys should be carefully examined for cracks and faults at least once a year.

Roof Coverings. Roof coverings should be of some non-inflammable material, especially if the house is exposed by forests or by other buildings. Shingle roofs are a decided menace and are seldom economical in the long run. Tile, slate, tin and gravel are perhaps the safest in the order named, and many of the prepared roofings are fair fire-retardants and can be had at a reasonable cost.

Height. The height should not exceed three stories, although under some conditions a four-story building might not be considered undesirable.

Area. The area in one fire section should not exceed 10,000 square feet ground area, including verandas and all additions, and should preferably not be over 5,000 square feet. This means that in large hotels standard fire walls should be installed at the necessary intervals. These should be of brick extending three feet above the roof and projecting five feet in the front and rear of the building. All openings should be equipped with standard automatic fire doors.

Fire Escapes. Substantial iron fire escapes should be placed on the outside of the building at the ends of all corridors and at any other important locations that would seem to call for them.

Hazards.

Heating. The heating should be by steam, with pipes properly bushed and arranged according to established good practice.

Boilers should be in a one-story detached building either of brick with plank and timber roof or entirely of fireproof construction, having floors of concrete or other non-combustible material.

Open fire places are probably too popular to be prohibited on the first floor; but they should never be allowed in guest's rooms, or in the upper stories. The chimneys and all brick work should be well built and the greatest care and watchfulness should be observed whenever wood fires are burning.

Stoves, where steam heating is impossible, should be installed and operated with the utmost care.

Lighting. The safest method of lighting is undoubtedly by electricity, and this has practically superseded all other light in up-to-date hotels.

The special hazards vary greatly with the size of the hotel. The large, isolated houses have the hazards of a small town, including kitchen, laundry, power plant, tailor shops, garage, paint shop, carpenter shop, machine shop, smithy, photographic work and printing departments.

Kitchen. The kitchen is the most common hazard, as it is found in all hotels, no matter of what size. The lives of the patrons should never be jeopardized by locating the kitchen in the main building or where a fire starting in this section could readily communicate to the hotel proper. It should always be in an addition cut off by a standard fire wall.

The ranges, broilers and bake ovens should be well set, and the floor underneath them and surrounding them for a distance of at least three feet in all directions should be strictly fireproof. There should be heavy metal ventilators over ranges and broilers to carry off all fumes and odors. These should be of riveted construction, so built and supported that they can be burned out without danger. They should be connected to a well-built flue, which is used for no other purpose. Grease and soot are bound to collect in such flues, and the easiest way of cleaning them is to burn them out.

Gas stoves of some sort are frequently used for quick cooking, and these should always be set on metal-covered or non-combustible tables. The piping should always conform to standard gas practice.

Laundry. The next most important hazard is the laundry. This can usually be located in a detached building without inconvenience, and this is the safest arrangement.

The best method of heating flat irons is by electricity installed according to the National Electrical Code, with a pilot light for each iron. Gas is perhaps the next best method; and when used great care should be taken to see that the entire gas supply is shut off every night. Flexible tubing should be of good quality and kept in good repair. The cock controlling the gas supply should never be at the end of the rubber tubing nearest the flat iron. Where neither of the above methods are available, stoves burning hard coal may be used. The stoves should be located on a fireproof section of flooring and surrounded, so far as possible, with a sheet metal guard. Care should be taken that the flue is well built and the smoke pipe properly supported. In any case, open iron rests should be provided for the irons.

Laundry driers should be enclosed in fire-resisting material as far as possible. Floors, walls and ceilings should be built of brick or concrete, and the racks themselves should be non-combustible. Steam is the most satisfactory heat, and pipes should be well mounted on iron and arranged so that any dirt that may collect around them can be easily cleaned out. Steam can also be used to heat the mangles, and is much safer than gas.

Garage. An automobile garage is now a necessary adjunct to every large summer hotel. Sometimes only a storage shed is necessary, but more often some facilities for light repair work are also required. If this is the case, there should be a fire cut-off between the storage section and the repair department. It is not infrequent that an old stable or barn is made use of for garage purposes, but such an arrangement is seldom desirable. A one-story building should be built for the purpose, located at least one hundred feet from other buildings. The floor should be of earth or concrete, and the walls tin clad or of some non-combustible material. An excellent arrangement is a long, narrow building divided by non-combustible partitions, such as corrugated iron into stalls just large enough to hold one machine; then if a fire occurs in one car there is less chance of its spreading to another.

The lighting should be electric, with no switches or fuses in rooms where there is liable to be gasolene fumes. The main supply of gasolene should be kept in an underground tank well isolated, and cars should always be filled at the tank and never in the garage.

Printing. Printing is done in many of the large hotels, but usually in a small way, for menus only. This department should never be located in the main building, and especial care should be given to cleanliness. If benzine is used for type cleaning, only a small supply should be kept in the building, and it should be used in safety cans.

Paint, Carpenter, Pipe and Forge Shops are often found connected with large hotels that are at a distance from any town. The proper care and arrangement of these hazards is too well known to need discussion, but in no case should these processes be carried on in or adjoining the main buildings. They should always be located in small, isolated buildings where a fire could do but little damage.

Protection.

Hydrants. A modern hydrant system, with yard mains not less than six inches in diameter and with frostproof hydrants located around the buildings 200 to 300 feet apart and about 50 feet from the buildings, is perhaps the most important protection feature. The water supply should be adequate to deliver two to four hose streams or more, according to the size of the structure, under a pressure of at least 55 pounds. Such a supply may be from public water works, if available, from private steam pumps of 500 to 1,000 gallons capacity, or from private reservoirs of 50,000 to 100,000 gallons capacity. Each hydrant should be equipped with a standard hose house, containing 100 to 200 feet of hose, and the standard equipment of nozzles, spanners, etc.

Ladders. There should be an ample supply of ladders kept on hand in a safe locality, well isolated from the main building so that all parts of the roof can be readily reached by hose streams.

Standpipes. These should be two to three inches in diameter, located so that there will be one for each 5,000 square feet floor area. These should be at convenient and conspicuous points, preferably in the hallways. The underground piping from the yard main should be not less than four inches in diameter, with a post indicator valve in the connection for shutting off water in winter. There should be a sufficient supply of small hose, preferably $1\frac{1}{2}$-inch with $\frac{1}{2}$-inch nozzles, on each floor to reach all parts of the floor. Unlined linen hose is the most satisfactory for this purpose. The water supplies should be at least 5,000 gallons for each standpipe, and the pressure on top floor should be at least 25 pounds.

Chemical Extinguishers and Water Pails. A few approved chemicals are always desirable. Where there are no standpipes there should be at least one approved chemical extinguisher or six standard water pails for each 2,500 square feet floor area. These should be distributed throughout the halls in conspicuous places.

Automatic Sprinklers. No frame hotel can be considered well protected unless it has a standard equipment of automatic sprinklers covering all hazardous sections. In one New England hotel the proprietors have gone so far as to equip the entire two upper floors as well as a tower section, basement, kitchen and laundry section, and other more or less hazardous rooms. This example might well be followed by other up-to-date hotel men. The most essential sections, however, are basements, kitchens, laundries and storerooms.

It is extremely desirable to have these sprinklers on a dry system and kept in commission the entire year.

Watchman's Service. Standard watchmen's service should be maintained while the hotel is open and while repairs or work of any kind are being carried on. A large number of hotel fires occur just before the house opens for the season or just after it closes. Therefore, it is of the greatest importance to have complete watchmen's service at such times. During the winter, however, when the hotel is closed, it is probably safer not to have a watchman enter the buildings, although it is desirable to have the outside thoroughly patrolled.

No watchman can be considered entirely reliable unless he makes standard hourly rounds registered on an approved clock, properly installed. Rounds may be made nights only while the hotel is open, but during repairs should be made during the day as well.

Only reliable, trustworthy men should be hired as watchmen. Many watchmen, whose only recommendation is the low price at which they will work, are really a menace to the property.

Private Brigades. Where hotels are remote from a town or village fire department, a private fire brigade should be maintained. A few high-class men should be chosen for this purpose and the engineer or someone else in authority should be appointed chief. Drills should be held regularly once a week during the season. No one who has not actually handled a hose stream can do effective work in case of emergency. All the hose and water in the world is of no value for fire fighting unless properly handled.

Management.

The greatest precaution should be exercised in the care and cleanliness of a summer hotel, A majority of fires are due to carelessness or ignorance, and a hotel manager is morally responsible for the safety of the guests under his roof.

Dirt should not be allowed to collect in any corner or out-of-the-way place. Dirty and oily rags and paper are especially dangerous, and should always be burned or carted away as soon as possible.

Empty boxes, barrels and packing material should not be allowed to collect in any part of the premises, especially in unused basements and under piazzas. The greatest care should be taken to keep the space under hotels and piazzas clean and locked, so that unauthorized persons cannot visit them, and possibly start a fire by smoking.

Old furniture or other rubbish should not be stored in attics or other unused places in the main building. Such material should be kept in outbuildings at a safe distance away.

No hazardous work, such as ironing, naphtha cleaning, brass polishing or repair work of any kind should be tolerated in the main hotel. There are plenty of safer places where such work can be done.

Safety matches only should be supplied in a summer hotel. The guests may carry off a few boxes as souvenirs, but under the worst conditions this could not prove very expensive to the management, and may be made to serve as advertising.

No heating apparatus, gasolene or acetylene generating apparatus should be located in the main basement. These should always be in detached buildings, and installed strictly in accordance with approved practice.

Summer hotels in the past have an undesirable record. In view of the large number of lives at stake in them, and the light inherent hazard, this unfavorable record should not be allowed to continue. It is obvious that these properties can be easily bettered, and it is hoped that the time is at hand when public sentiment will demand the improvements necessary to make them reasonably safe against fire.

The Corrosion of Metals Underground by Electrolysis.

By A. A. Knudson, Electrical Engineer.

(By courtesy of the Franklin Institute.)

The object of this paper is to set forth somewhat briefly the present status of electrolytic action upon subsurface metals due to railway currents, and to illustrate with some items gleaned from practice the movements and effects of such currents.

Attention will first be given to some features pertaining to the cause of railway currents flowing into and following underground pipes and other metals and afterwards consideration to some of the destructive effects from this cause.

A glance at the construction of the single trolley system will first be made in order to fully appreciate the results of such construction upon underground metals.

It is fairly well known that the single overhead wire reenforced by copper feeders carries the current to the cars, thence through the motors and wheels to the rails which are employed to return this current to the power house. As is well known the rails are buried to their top surface in the soil, and therefore this side of the circuit is permanently "grounded." Here is where the trouble from electrolysis comes in, for in the same soil in the average city and town, a few feet below the surface there is a gridiron of water-mains and a gridiron of gas mains, besides other metallic conductors. Under the law of divided circuits these underground mains represent other paths by which a portion of this current is bound to flow and, therefore, it divides itself among them all, some passing by the way of the rails and their auxiliary feeders when they are provided and some by the way of mains, in the inverse ratio of their several resistances in accordance with this law, the damp soil acting as the conducting medium between the rails and mains. Where the current passes out of these mains to the soil on its way to some neighboring main, or to some water-course leading to the power

house, or again to the rails in the vicinity of a power house, electrolytic action, commonly called electrolysis, takes place, resulting in the destructive effects which are now quite familiar.

The condition of the track circuit has much to do with the proportion of current that may leave it and pass into the mains. With heavy 90 and 100 pound rails well bonded and with auxiliary copper feeders a much less amount will pass off to other paths than if the rails are light and poorly bonded, with no feeders. The former construction is generally found in the central or busy parts of a city, while the latter usually prevails on the more distant sections or suburbs. If the entire track circuit in a city were constructed as in the former case it would not mean perfect immunity from electrolysis, as some current even then would pass by way of other indirect paths underground.

We shall endeavor to illustrate with views divided in two groups both the cause and effect of electrolytic action; the first group represents the cause, and some of the peculiar current movements underground will also be referred to, while the second group will refer to effects or damage to mains and other metals.

Cause of Electrolysis.

Fig. 1 is a typical map and illustrates the usual flow of current upon mains in any city where the single trolley system is in operation; with the power house located upon the bank of a river or other water-course.

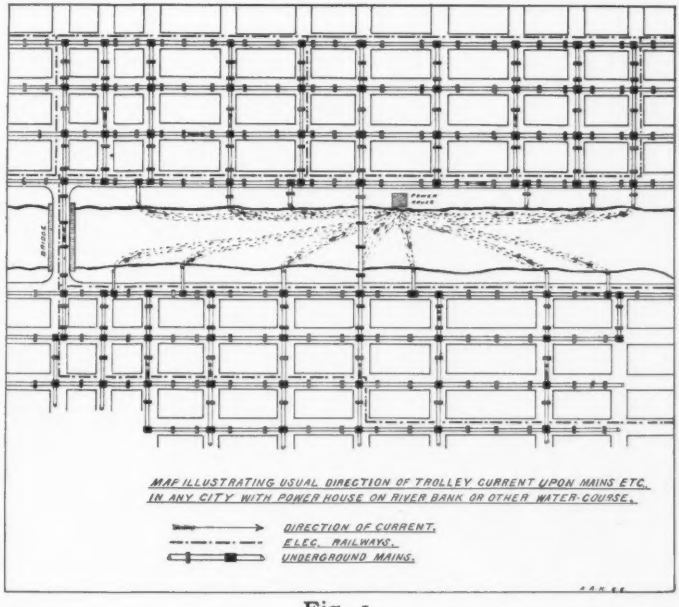

POWER HOUSE
BRIDGE
MAP ILLUSTRATING USUAL DIRECTION OF TROLLEY CURRENT UPON MAINS ETC. IN ANY CITY WITH POWER HOUSE ON RIVER BANK OR OTHER WATER-COURSE.
DIRECTION OF CURRENT.
ELEC. RAILWAYS.
UNDERGROUND MAINS.

Fig. 1.

Such an arrangement is quite common and as the effect is much the same among them all so far as the direction of currents are concerned we have chosen this method of illustrating a number of cases.

It will be noticed that not only do these currents flow across the river to the power house but also along the banks of the side upon which it is located.

A water or gas main as indicated in Fig. 1 passing across a river bed is one path for a returning current often found. Such pipe is quite likely to be damaged by electrolysis, particularly if in salt water, as when it conveys current some is sure to leave it and pass into the mud bottom or river, thence to the power house by way of the pipes used for condensing. This back door entrance in many cases is a matter of much concern to railway companies, passing as it does into the intake pipes, thence through steam and condensing apparatus, resulting in electrolytic injury and often necessitating extensive repairs. This effect may be fairly termed the "boomerang" of the single trolley system.

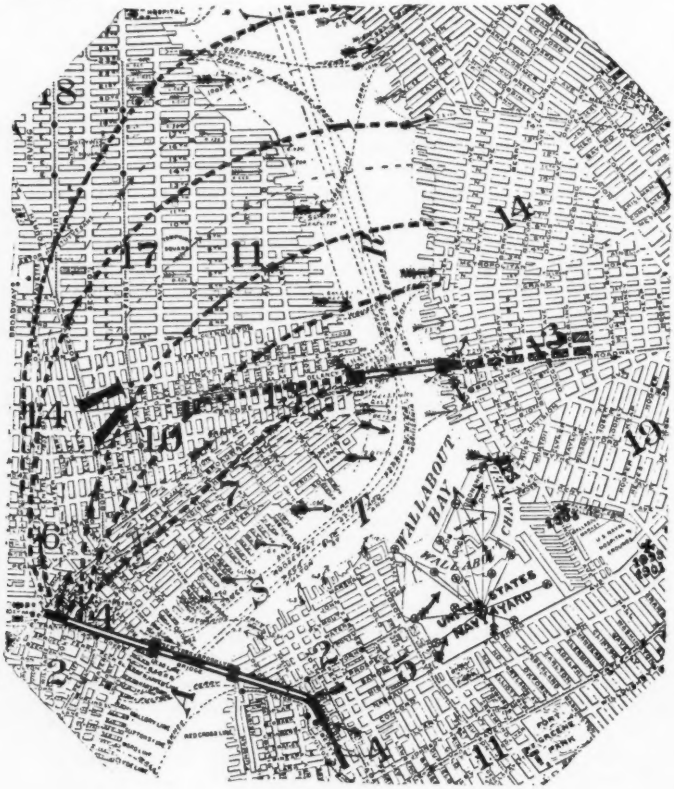


Fig. 2.

It has been found that a considerable proportion of trolley current will seek a river or other nearby water-course in preference to following an underground main or even the railway track return whenever the conditions offer an opportunity.

The next illustration (Fig. 2) of straying currents is a section of New York City showing the flow to be over the Brooklyn Bridge to Manhattan Borough, thence through the underground metals to and over the new or Williamsburg bridge, thence over that bridge and returning to the power house in Brooklyn at Kent Avenue through underground mains in Brooklyn.

Before the new bridge was built this current spread as far north as 23rd Street, about two miles, before entirely crossing as shown by the lines and arrows. Now, however, the new bridge with its mass of metal is acting as a "short circuit" and most of the current recrosses the river through it.

One test for current flow was made upon the Brooklyn side of the new bridge upon a 6-inch water pipe coming down from the structure and a maximum of nearly 70 amperes was found passing through it directly into the water mains and thence towards the Brooklyn Power House. This, however, was only one path; there are many others, such as the metal foundations of the pillars where the current may pass out into the soil and cause electrolytic action. In this same section of New York is located the U. S. Navy Yard, where considerable damage by electrolysis has occurred to the pipes underground.

A method employed by the officers in charge, in keeping track of the direction and force of these currents is through potential measurements between different points of the Yard.

Wires are run from a central station to 12 or 13 different points connecting with the water pipes at each place. By this arrangement voltmeter readings can be taken between any two of these points and in this way some knowledge of their direction and force is had.

Several potential tests have been made about the bridges in New York. The one recorded by Fig. 3 was taken in April, 1904, during a so-called "rush hour" between 5 and 7 P. M. between a pillar of the New York and Brooklyn bridge structure on the Manhattan side and a water main.

This will give an idea of how the change in strength of the railway current which is governed by the changes in traffic is reflected between other metals underground. The bridge was positive to the mains, showing currents coming over from Brooklyn and passing into them as well as other metals. It will be noted that beginning at 2 volts a little after 5 o'clock the rise is quite rapid until 3.6 volts is reached several times between 6 and 6.35, after which it begins to fall off, when at 7 o'clock after most of the crowd has been carried home it is back to 2.4. This rise and fall of potential therefore corresponds to traffic changes on the cars and is one means of establishing when necessary the identity and source of these currents.

A more complete method for observing the roaming of trolley currents through other people's property and the damage caused, is by current

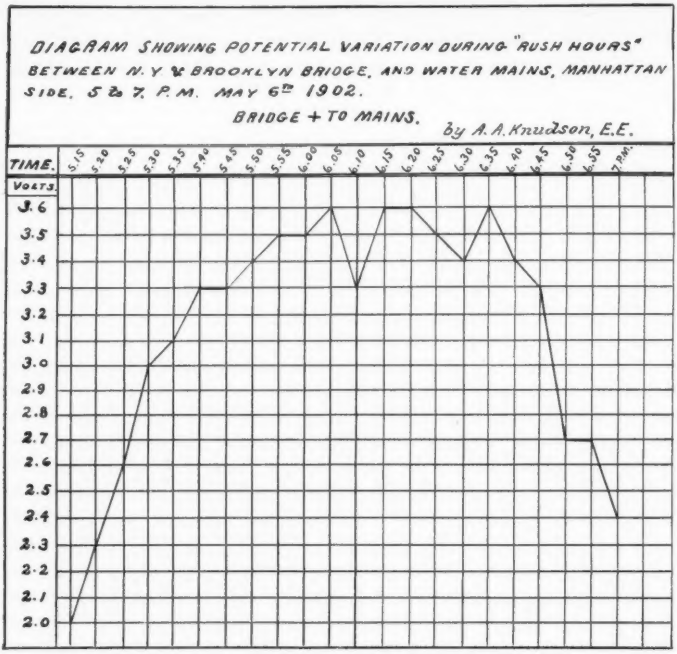


Fig. 3.

measurements upon the mains. This is often conveniently ascertained by the drop of potential test in a given number of feet upon a known size of pipe, the resistance of which has been previously determined, and by the application of Ohm's law the flow of current in amperes is found.

In many cases permanent stations are now installed upon important mains by screwing into them brass plugs, usually 10 feet apart, to which are attached insulated wires; these are led to the surface of the street and the ends secured in a box. By this arrangement periodical tests are made, and a record kept of the current in amperes, which is found by millivoltmeter readings in the manner stated. Sometimes when found desirable these current measurements are taken every few minutes throughout the 24 hours.

The diagram Fig. 4 represents the graphic tabulation of these readings taken upon a 36-inch water main and also upon the same map a second curve line is placed giving the "load" line or "log" of a power house; the readings of both are placed at the same hours. The purpose of this illustration is to show at a glance how the variations of current strength upon the railway lines is faithfully reflected in the variation of current strength upon underground mains, it will be noticed that the high and low readings occur at precisely the same hours of the 24, thus com-

pletely identifying the current. The periodical tests which are carefully compiled in tables are kept as records for future use, so in case it is found that important mains have been badly depreciated by electrolysis by currents flowing through them, a city or water company would be in a position to fix the responsibility.

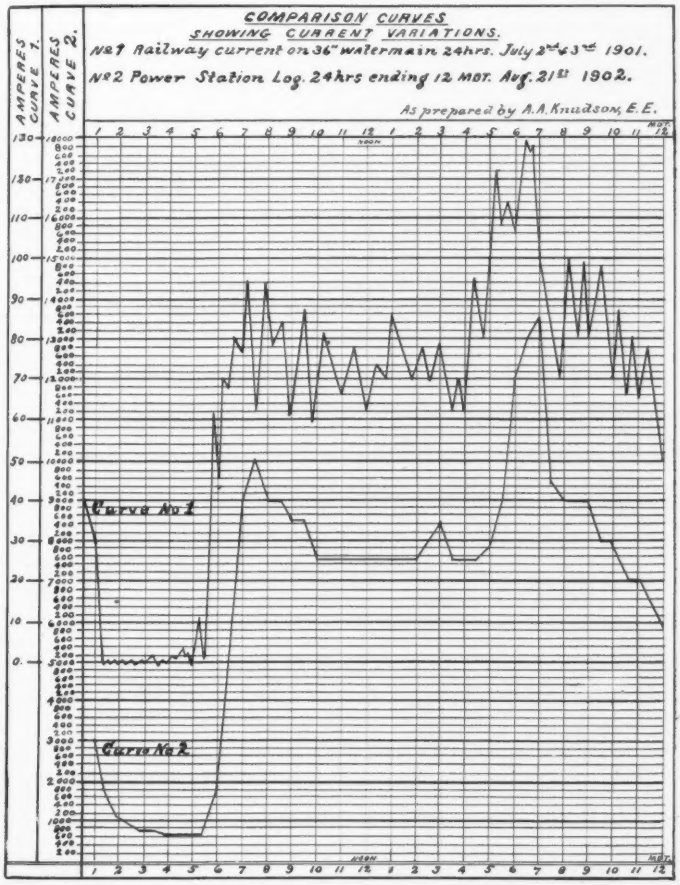

COMPARISON CURVES
SHOWING CURRENT VARIATIONS.
No 1 Railway current on 36" water main 24 hrs. July 2nd & 3rd 1901.
No 2 Power Station Log. 24 hrs ending 12 MDT. Aug. 21st 1902.
As prepared by A.A. Knudson, E.E.
AMPERES CURVE 1.
AMPERES CURVE 2.
Curve No 1
Curve No 2.

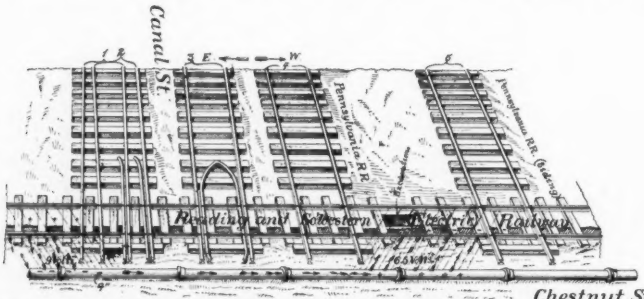
Fig. 4.

Another effect of the movements of underground current is its transfer from one pipe to another underground. This occurred in an 8-inch water main, and two 6-inch wrought-iron pipes used for conveying oil to the seaboard passing over the top of the main at right angles about 3 feet apart. The water main for about two lengths (25 feet) was nearly

ruined by electrolysis at this point. It was found positive to the oil pipes, at times to 6 volts, and was in continually wet soil, the conditions all being favorable for electrolysis.

Tests upon the street, however, failed to show this action at all, the main was negative to the rails, and had it not been uncovered its condition would not have been known until it had burst. This is but one case of many that are never discovered until a leak is reported; the usual condition, however, is where a current passes from one water main to another or between a water main and a gas main underground.

The result of a bad track crossing at Reading, Pa., is shown in Fig. 5. The main under the tracks was found acting as a bridge for the returning railway current as the bonds on the crossing were defective; the pipe burst during examination at one of the soft spots caused by electrolysis.



P.R.R. and Philadelphia and Reading Railway Crossing at Chestnut and Canal Sts. Reading, Pa.

Fig. 5.

The preceding illustrations all refer to the cause of electrolytic action upon mains. We will now turn our attention to the other feature of the case and with a few views illustrate the effect upon underground metals.

Effect of Electrolysis.

There are two distinct phases of electrolytic action upon underground mains; one is the lateral effect, where the current in passing out from the body of a main causes pitting and disintegration of the iron, the other is the effect of current flowing through a main, causing damage at the joints.

First, as to the lateral effect. In cast-iron mains soft spots or furrows form, which are filled with carbon similar to an artificial graphite. In steel or wrought iron the effect is a shredded appearance with but little carbon.

Figs. 6, 7 and 8 show some lateral effects. The first is a reproduction of a photograph which was made from a drawing, and represents a number of these pittings, about eighty in all, ranging in depth from $\frac{1}{8}$ of an inch to 9-16. This drawing was made from a careful examination of a 12-foot length of a 48-inch cast-iron main, and is a plan view of the entire

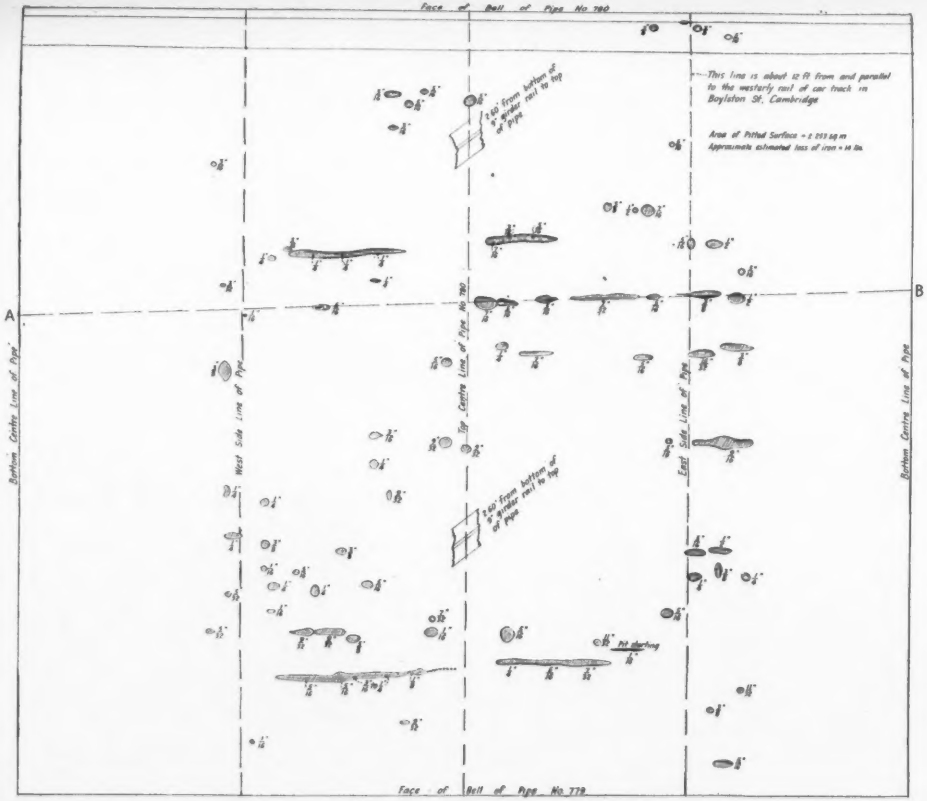
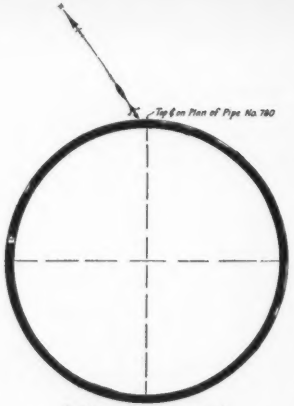

Face of Bell of Pipe No 780
This line is about 12 ft from and parallel to the westerly rail of car track in Boylston St. Cambridge
Area of Pitted Surface = ± 253 sq in
Approximate estimated loss of iron = 14 lbs.
3.40' from bottom of westerly rail to top of Pipe
3.10' from bottom of westerly rail to top of Pipe
Bottom Centre Line of Pipe
West Side Line of Pipe
Top Centre Line of Pipe No 780
East Side Line of Pipe
Bottom Centre Line of Pipe
Pit starting
A
B
Face of Bell of Pipe No 779

Fig. 6.



Section of 48"Pipe on AB

About 85% of the pittings on this pipe are indicated on this plan, the others are less than ¾" in diameter or than ¼" in depth and were not located

Commonwealth of Massachusetts
Metropolitan Water Works
Distribution Department

Plan of Surface of 48" Pipe No. 780 showing location and depth, on Nov 24, 1902, of Pittings caused by Electrolysis.

Pipe laid Sept 5, 1896 under centre track leading to Car House of the B. E. Ry Co on Boylston St. near Eliot St Cambridge.

Scale, 2 in. = 1 ft. Dec 5, 1902.

surface; it shows not only every pitting, but their size and shape, with the depth marked at each one. Most of the data is marked upon the plan, but the following will be of interest.

Difference of potential between pipe and rails, 5 to 15 volts—15 volts occurring at peak load—daily average 8 volts. Current flow on the main 5 to 95 amperes, daily average 50. Distance top of pipe to bottom of rail 2.6 feet. Power house furnishing this current put in operation November, 1897. Examination made November, 1902; length of time these conditions were in full force to cause the damage, between 4 and 5 years.

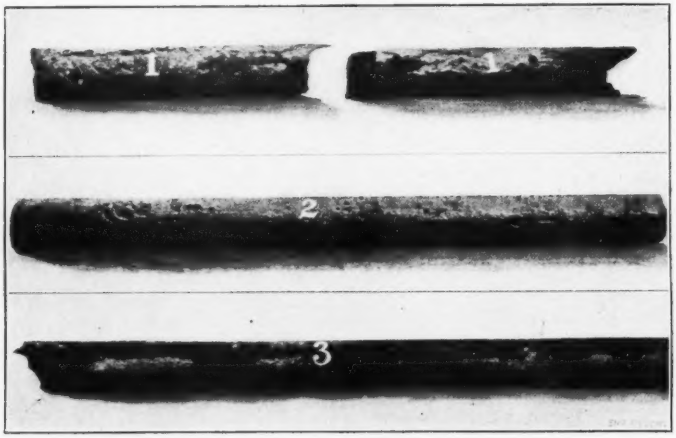


Fig. 7.

The next illustration, Fig. 7, is one of three sections of a pipe discovered at Reading, Pa., which shows how ruinous is the effect of electrolytic action in some cases. No. 2 was in the ground less than one year and nearly eaten through. No. 3 is the one that burst when we were exam-

Fig. 8.

ining it at the railway crossing previously spoken of, the hole being at the left end of the piece, another hole is near the right end.

The next view, Fig. 8, is a fragment of 6-inch pipe from Brooklyn, N. Y. This burst, owing to electrolysis, about one year ago, was the cause of the waste of a large amount of water, which ran off into a canal nearby

and did not show on the surface of the street. No one connected with the Water Department can tell how long this water was flowing to waste; the break was discovered by accident, a heavy truck wheel breaking through the ground, which had been hollowed by the force of water flowing away. This pipe was positive to the trolley rails to nearly 6 volts, and also plus to a gas pipe in the same street and the water of the canal, indicating current flowing from it in three different directions.

Fig. 9.

The next section of a pipe shown (Fig. 9) is from an 8-inch cast-iron main also taken from a street in Brooklyn. It is made of Scotch iron, one method of identifying which is the bulging rings on each length. One of these rings is shown near the left hand end. At one time it was thought by some that this quality of iron pipe was immune from electrolysis, but that idea has long since been proved a fallacy in many cases similar to this.

We will now pass to the other phase of electrolytic action, namely, corrosion of the joints of mains, particularly water pipe joints.

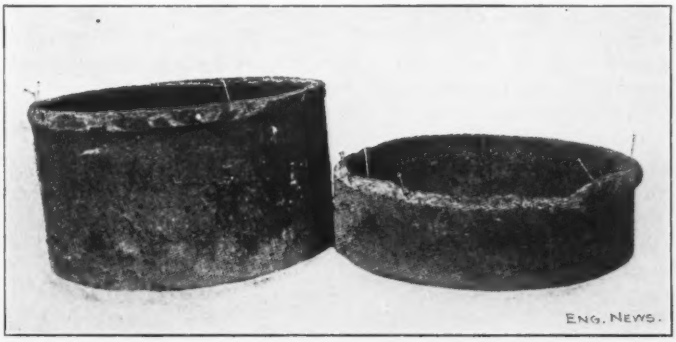


Fig. 10.

The first view (Fig. 10) is from a photo of two ends of a 16-inch water main from Peoria, Ill., and shows very clearly how the pipe was injured by electrolysis upon the inside of the joint. We are informed by Mr. D. H. Maury, consulting engineer in charge of the Water Company, who

made this discovery, that of the 1,000 feet of this pipe removed from the ground every joint showed more or less of this action; at some places near the end of the pipe the metal was softened or eaten away for more than an inch.

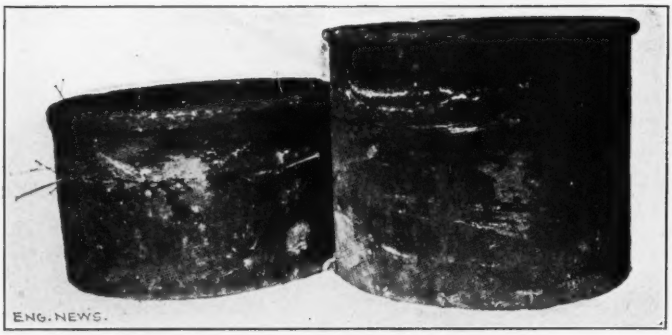


Fig. 11.

Two other photographic views (Fig. 11) of this same pipe illustrate electrolytic action upon the outside of the main close to the lead packing of the joint; this is indicated by the row of nails driven in on the softened iron, showing the shunting effect of the current; this pipe was taken up owing to a change in pumping works, a new one having been built. We are also informed that at no other place upon this pipe, except at the spigot ends, were there any signs of electrolysis, the direction of current through the main being from spigot to bell.

Fig. 12 is from a photograph of 6-inch pipe from New Bedford, Mass. This had previously lain in the river; it has a ball-and-socket joint, and was in preparation for further use. We discovered during an investigation in that city that a number of the ends were badly softened and much weakened by electrolysis, the nails driven in at some of the soft places show where they were damaged; when the attention of the superintendent was called to this damage he promptly condemned several lengths as being unfit for further use.

We will now give our attention briefly to electrolytic action upon water meters.

This part of the subject, so far as we know, has not before been touched upon. It shows, however, that there are other metals underground besides pipes that are affected by electrolysis; and not the least important among them is water meters.

Two recent meter examinations made by the writer in two different cities revealed the fact that in a number of cases meters were injured by electrolysis; this is owing principally to their location. In many cases, to prevent freezing, meters are placed in pits 3 to 4 feet below the surface of

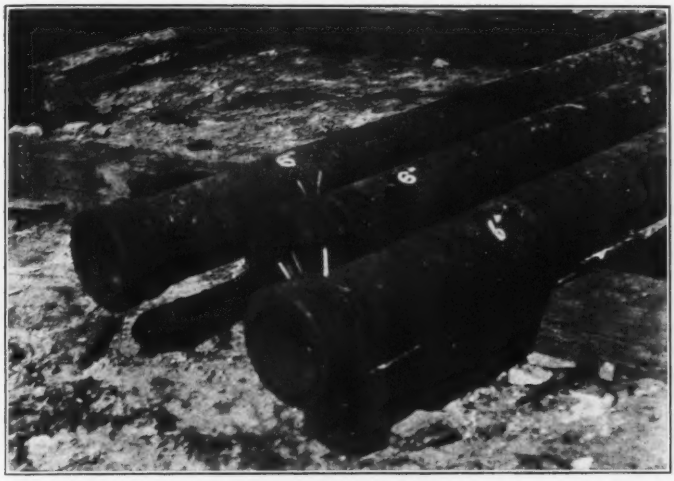


Fig. 12.

the ground, the bottom and sides of the pits boarded up and provided with wooden covering. Some of these are placed under the docks along a river front, and many in the cellars of dwellings and stores.

It will be readily seen that in the latter case the meter pit is practically a cesspool, as it is the lowest part of a cellar and collects the drainage of whatever liquids may be upon the cellar bottom, the quality of which will usually make a good electrolyte (and the same will apply to meter pits under stables, in such case there is a large percentage of ammonia in the solution), and it is well known that this ingredient materially helps electrolytic action.

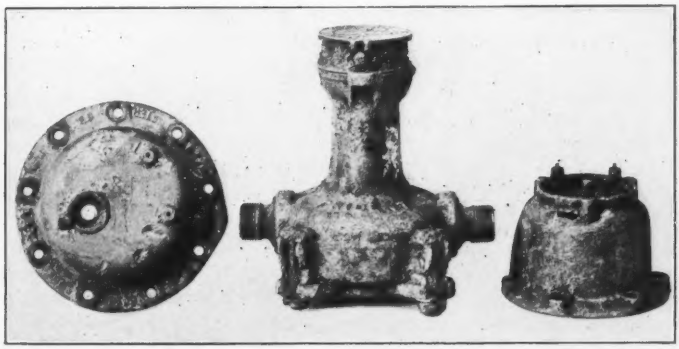


Fig. 13.

Fig. 13 is a photograph of the upper parts of two meters and the whole of a third, all showing the effect of electrolysis and the very evident cause of their removal.

At all of the places where meters had been similarly damaged in this investigation, in making tests it was found that those which took their place positive to the soil or gas pipe were the ones damaged. With the usual trolley current variation, such tests were usually made with a millivoltimeter, the readings taken between the meter and an iron bar driven down in the wet soil alongside of the pit, the variations in most cases running from 20 to at times as high as 250 and 300 millivolts. These samples were taken from a number similarly affected.

Fig. 14.

Another photograph (Fig. 14) shows the under side of a 4-inch meter which was practically destroyed by electrolysis. It was placed in a pit at a ferry house where tide water had access. The potential measurements showed the pipes which had connected with the meter to be positive to nearby trolley rails from 5 to 7 volts. This meter was in use 6 years and 8 months; the under side was softened nearly through the iron, as shown where it has been cut away, and a knife blade pushed in up to the handle. The fish-trap connected to it had several holes in it, as shown in the next photograph (Fig. 15). The actual loss in weight of iron through electrolysis was carefully ascertained and found to be just 15 pounds.

In another city where a meter smaller than the above was placed in a pit at a dock and subject to tide water, it was found when the pit was pumped out and an examination made, that the service pipe on both sides of the meter had burst, owing to electrolysis, the larger leak on the consumer's side explained the cause of abnormally high meter readings as well as the vigorous protests on the part of the consumer when bills were rendered.

The meter was also somewhat damaged. It was found positive to the river, the same as in other cases along the docks. The power house was upon the opposite side of the river, and this current leaving pipes and meters was flowing across, as has been illustrated in the map (Fig. 1).

It may seem strange that no better setting of water meters is made than in the places referred to. In many cases, however, where the ground is low, it is practically impossible to keep them dry more than one month in the year, those near tide water being partially or wholly submerged every day in the year. In some cities a better method is used for setting meters, such as placing them in a water-tight iron box below the sidewalk in the street, and from the best accounts obtainable freezing is avoided as well as electrolysis.

Fig. 15.

There is one other view (Fig. 16) which may be interesting in illustrating the effect of electrolytic action upon the partially exposed iron or steel work of bridges, and showing the distinction between ordinary corro-

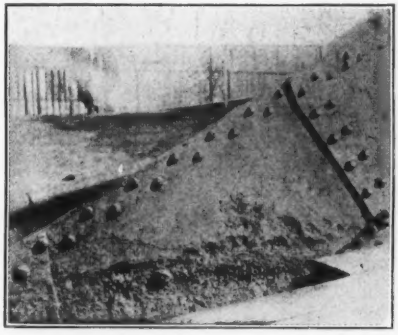


Fig. 16.

sion and electrolytic action. This does not, of course, refer to underground foundations or cable anchorages, but to the metal work of the shore spans or trusses where the heavy planks of the roadway rest against or nearly against them. Between the planks and the metal is usually lodged the

sweepings of the bridge, which consists almost entirely of animal refuse; this will and does cause corrosion where there is no current present, but when current is flowing from the iron to the surrounding soil it passes through this material, and to the planks which are often wet and damp. In this particular case, which was of a bridge at Providence, Rhode Island, each one of the four shore ends of the trusses was carefully tested. At three of them no sign of current could be found, and a removal of the planks disclosed but little corrosion; at the fourth, however, which is the subject of this photograph, a difference of potential of from 4 to 6 one hundredths of a volt was found with the truss positive to the soil.

As will be seen, part of the iron plate of the truss which lay next to the planks was quite badly corroded, the iron which was originally ⅜-inch thick was reduced for a considerable space to about the thickness of paper, and penetrated in three places—two of the holes are shown in the photo, the third was discovered after it was taken. This distinction, therefore, between ordinary corrosion of metals and corrosion caused by electrolytic action, we regard as quite marked.*

Some further tests were made in another city, upon water mains that were found accessible. Not far from the entrance to a cemetery there is a 48-inch main resting upon a wooden trestle, as it crosses a small valley. Railway current was discovered flowing through this main from 20 to 50 amperes. When a current of electricity is found flowing through an important main, if only 5 or 10 amperes, it is well to learn, if possible, where it is coming out, because at such points electrolysis takes place. About half a mile north of the test in the cemetery this main crosses an avenue, upon which is a double-track trolley road. The main was found highly positive to these tracks, indicating this to be the point of delivery for this current, and as the power house is a short distance west, it is most natural for this current to pass out of the main to these tracks and thence to power house.

A number of precedents in similar cases in our own experience justified our prediction, made to the superintendent of the water bureau, that this main was being damaged by electrolysis under these tracks, and it was but a question of time, if these conditions continued when it would be in grave danger of bursting.

He informed us that if such a thing should happen it would cut off the water supply of a large section of the city until it could again be repaired. Another effect would be the heavy cost of damage to property through the sudden letting loose of a huge mass of water, as well as the heavy cost of repairs. One experience of this kind has recently been had in this city and a repetition of such an accident would be very undesirable. We are informed that the cause of this break, however, was a defect in the iron of the pipe.

Since we reported these conditions, changes made have considerably improved the situation, as further measurements show. For instance, in-

* Since this paper was prepared this bridge has been replaced by a new one. The underground chords when uncovered were found badly corroded and weakened from electrolysis.

stead of 40 to 50 amperes of current discovered flowing *north*, there is now but 5 to 15 amperes, and it is flowing in the reverse direction, *south*. Instead of the main being highly positive to the rails on the avenue, as found at that time, it is now negative to the rails, from 3 to 4 volts. Just how much this main is damaged by electrolysis under these tracks depends somewhat on the length of time these conditions were in force before the change was made. It would be interesting to know also where the average current of 10 amperes now flowing south through it is coming out.

One method used in some cities for relieving mains from electrolysis at badly affected places is to bond them to the rails or railway return. This we have always opposed for the reason that more current flow is invited upon them and electrolytic action takes place at the joints, mostly inside, if a water main, illustrations of which we have shown in several views.

We do not believe it to be good policy where the future is considered to allow either the water or gas piping system in any city to be practically converted into a railway return by bonding.

We have only touched briefly upon various points as to *cause* and *effect* of electrolysis upon underground metals, we will now turn our attention in conclusion to a few remarks as to the prospect of *remedy*.

Under the present system of operating street cars with its "grounded" track return there can be no other result under the law of divided circuit but that more or less railway current will pass to and through underground metals, causing electrolysis among them in a greater or less degree according to local conditions. This diversion of current from rails to mains is restrained in some cases by liberal use of copper in the auxiliaries, but even then there is sure to be escape at some parts of the system, practical illustrations of which having just been shown.

The late I. H. Farnham, one of the first investigators in electrolysis, stated in a paper read before the Institute of Electrical Engineers in New York in 1894 that—"In some cities where electrolysis is in progress today, the return copper nearly equals that of the trolley and feed-wire system. We cannot force a current to take one path exclusively when others are open to it." This statement was made 15 years ago; since then there have been many electric railway lines built, but excepting the double underground trolley in New York and Washington there has been no other system brought into general use than the present single trolley.

The present status therefore as to the cause and effect of electrolysis does not differ much from the conditions as they existed ten years ago, except there is a tendeney for better construction on the part of the railways, which modifies the effects but does not cure the trouble.

In the evolution of the electric railway it is impossible to say if the next step is to be a method which will or will not cause electrolysis. The double trolley has been largely advocated and both the overhead and underground methods have been in practical use for years.

An improved storage battery has been looked to as a possibility. A modification of the gasolene engine as used in automobiles is another possi-

bility. Any of these methods will of course avoid electrolysis. The latest, however, which is attracting considerable attention as a possibility is the alternating current method.

We are not prepared to say what the effect of alternating currents will be. In one case a laboratory experiment showed that the metal was removed from each electrode and deposited between them. If this is to be the result in practice then not much help can be expected from this direction, but it is to be hoped that some system will be evolved that can be operated without a "ground" and will result in final avoidance of electrolysis or corrosion to underground metals.

Committee Reports.

MEETING OF THE EXECUTIVE COMMITTEE.

H. L. Phillips, Chairman,
5 Haynes Street, Hartford, Conn.

A meeting of the Executive Committee was held on Thursday, September 9, 1909, in the rooms of the New England Insurance Exchange, 141 Milk Street, Boston, Mass., the following members being present:

Mr. H. L. Phillips, Chairman, Hartford, Conn.; Mr. Albert Blauvelt, Chicago, Ill.; Mr. G. E. Bruen, New York (representing Mr. Miller); Mr. George W. Cleveland, Cincinnati, Ohio; Mr. T. Z. Franklin, Philadelphia, Pa. (representing Mr. Wiederhold); Mr. C. M. Goddard, President, Boston; Mr. H. C. Henley, Vice-President, St. Louis; Mr. H. E. Hess, New York; Mr. Charles A. Hexamer, Philadelphia, Pa.; Mr. F. E. MacKnight, Atlanta, Ga.; Mr. W. H. Merrill, Chicago; Mr. C. H. Phinney, Boston; Mr. M. D. Pierce, New Orleans, La.; Mr. W. S. Wensley, New York; Mr. Franklin H. Wentworth, Boston. By invitation: Mr. William A. Anderson, New York; Mr. W. C. Robinson, Chicago, Ill.

Mr. H. L. Phillips was unanimously re-elected Chairman for the current year.

Consideration was given to the matter of the Publicity work of the Association, and it was voted that the same be continued by the President and Secretary, the following suggestions being made for their guidance in the work:

1. That the publication of special articles in the daily press be continued.

2. That copies of such articles be sent to all members either by printing in the QUARTERLY or otherwise.

3. That reports in the daily papers of large fires or fires of special interest be noted, with the object of forwarding suitable propaganda matter to editors of papers in such localities.

4. That the co-operation of all N. F. P. A. members be solicited in furthering the educational work on all occasions which may be presented.

5. That as far as possible a speaking campaign be arranged by the Secretary, speakers being offered to active members, commercial clubs, boards of trade, and other organizations which may be interested.

The Secretary was instructed to address active members offering delegates or speakers at meetings of their constituent members.

A special committee was appointed on Progress of Installations of High Pressure Fire Service systems and apparatus used in connection therewith. (See directory.)

It was voted that the committee on Manufacturing Risks and Special Hazards be requested to report list of subjects which should be taken up under this head, and also to report on one subject illustrating general form in which all others should be reported.

The matter of Frozen Fire Hydrants referred to Executive Committee at annual meeting was referred to Committee on Hydrants and Valves, and it was voted that this committee be requested to take up for consideration the subject of public fire hydrants.

The Committee on Artificial Refrigeration was merged in the Committee on Manufacturing Risks and Special Hazards.

The Committees on Fire Proof Construction and Concrete and Reinforced Concrete for Building Construction, E. T. Cairns, Chairman of both Committees, were consolidated, the title of the Committee being "Committee on Fire Proof Construction, Including Concrete and Reinforced Concrete."

The work of the Committee on Pipe being completed, the Committee was discharged.

A new committee on Cold Storage Warehouses was appointed. (See directory for this and other changes and additions to committees.)

It was voted that the next annual meeting be held in Chicago, May 17, 18 and 19, 1910.

Franklin H. Wentworth, *Secretary.*

New Members.

LIST OF MEMBERS ELECTED BY THE EXECUTIVE COMMITTEE SINCE JUNE, 1909.

JULY, 1909.

Associate.

Mr. J. C. Adderly, Special Agent, Millers National Insurance Co., 545 Geyer Road, Kirkwood, Mo.
Mr. R. H. Colcock, Jr., Liverpool & London & Globe Insurance Co., P. O. Box 455, San Antonio, Texas.
Mr. James S. Hereford, Special Agent, North British & Mercantile Insurance Co., Dallas, Texas.
Mr. John M. Hopkins, State Agent, Springfield F. & M. Insurance Co., P. O. Box 27, Houston, Texas.
Mr. I. Jalonick, President, Austin & Commonwealth Insurance Co., Dallas, Texas.
Mr. Charles M. Kerr, Special Agent, Farmers Fire Insurance Co., 53 E. Market St., York, Pa.
Mr. A. M. Paddon, Special Agent, Underwriters' Laboratories, Inc., Schenectady, N.Y.
Mr. William Pateman, Manager for South Africa, Royal Exchange Assurance, The Arcade, Market Square, Johannesburg, Transvaal.
Mr. A. R. Phillips, Special Agent, Insurance Company of North America, P. O. Box 902, Dallas. Texas.
Mr. E. D. Phillips, Inspector, Texas Fire Prevention Association, 822 Wilson Building, Dallas, Texas.
Mr. Frank L. Pierce, President and Treasurer What Cheer Mutual Fire Insurance Co., P. O. Box 1546, Providence, R. I.
Mr. H. C. Reynolds, Inspector, Southeastern Underwriters' Association, 529 Equitable Building, Atlanta, Ga.
Mr. J. T. Sharp, Secretary, Mill Owners Mutual Fire Insurance Co. of Iowa, Manhattan Building, Des Moines, Iowa.
Mr. Charles H. Storts, Special Agent, J. D. Kitchen & Bro., Box 485, Fort Worth, Texas.
Mr. Charles A. Tompkins, Assistant Secretary, What Cheer Mutual Fire Insurance Co., P. O. Box 1546, Providence, R. I.
Mr. William Blachford Woodrow, President, William B. Woodrow Co., Apartado 506, Mexico City, Mex.
Prof. Ira H. Woolson, E. M., Consulting Engineer on Tests of Materials, Columbia University, New York, N. Y.

Subscribing.

A. B. Banks & Co., General Agents, Fordyce, Ark.
Mr. H. W. MacBean, Secretary, The Shredded Wheat Co., Niagara Falls, N. Y.
Biersach & Niedermeyer Co., 216–220 Fifth St., Milwaukee, Wis.
J. F. Blanchard Co., Fuller Building, New York, N. Y.
A. M. Castle & Co., 217–221 N. Jefferson St., Chicago, Ill.
Mr. E. G. Cowdery, Vice President, People's Gaslight & Coke Co., Chicago, Ill.
E. I. du Pont de Nemours Powder Co., 703 du Pont Building, Wilmington, Del.
Mr. Walter L. Eustis, Engineer, The J. G. Brill Co., 62d St. and Woodland Ave., Philadelphia, Pa.
Ever Ready Manufacturing Co., 44 Pearl St., Buffalo, N. Y.
Mr. W. T. Cole, General Manager, Fabric Fire Hose Co., Sandy Hook, Conn.
The Garth Company, Iron and Brass Founders, Montreal, Que.
The E. Howard Clock Co., 373 Washington St., Boston, Mass.
Hopmann Cornice Co., Sheet Metal Mfrs., 2571-73 Benton St., St. Louis, Mo.
Insurance Society of New York, Room 3069, 84 William St., New York, N. Y.
Mr. Charles C. Irwin, Treasurer, Thomas W. Irwin Mfg. Co., 411 Rebecca St., North Side, Pittsburg, Penn.

Keasbey & Mattison Company, Ambler, Penn.
Mr. William McGrath, Fire Chief, D. L. & W. R. R., Hoboken, N. J.
Mr. C. A. Miller, Manager Metropolitan Fire Extinguisher Co., 1133 Broadway, New York, N. Y.
Mr. George C. Neal, Deputy Chief of District Police, State House, Boston, Mass.
Parrish & Thornton, Managers, The London Assurance Corporation, Pine and Sansome Sts., San Francisco, Cal.
Penn Iron Mining Co., Vulcan, Mich.
Simplex Time Recorder Co., P. O. Box 32, Gardner, Mass.
Mr. C. E. Skinner, Westinghouse Electric & Manufacturing Co., Pittsburg, Pa.
Mr. N. Slater, Allith Manufacturing Co., Ltd., Hamilton, Canada
Trezevant & Cochran, General Agents, P. O. Box 119, Dallas, Texas.
Sykes Steel Roofing Co., 112–120 19th Place, Chicago, Ill.
Mr. C. E. Trapp, Fire Chief, D. L. & W. R. R., Buffalo, N. Y.
Mr. J. H. Walker, Fire Chief, D. L. & W. R. R., Scranton, Pa.

AUGUST, 1909.

Associate.

Mr. C. P. Faunce, General Agent, Holyoke Mutual Fire Insurance Co., Salem, Mass.
Mr. John W. Friend, Jr., Special Agent, Phœnix Insurance Company of Hartford, Petersburg, Va.
Mr. E. W. T. Gray, Continental Insurance Co., P. O. Box 2038, New York, N. Y.
Mr. A. Hutchinson, Branch Manager, Canadian Fire Insurance Co., 18 Toronto St., Toronto, Canada.
Mr. Fielding Smith, Inspector, The Cotton Insurance Association, 1110 Empire Building, Atlanta, Ga.
Mr. Alfred Stumpe, Clerk, New York Fire Insurance Exchange, 32 Nassau St., New York, N. Y.

Subscribing.

Atlantic Hydraulic Machinery Co., Drexel Building, Philadelphia, Pa.
Mr. Robert L. Cooney, Glisson Fire Extinguisher Co , Atlanta, Ga.
Mr. F. L R. Francisco, Chief Engineer, The American Tobacco Co., Room 1008, 111 Fifth Ave., New York, N. Y.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Hamburg-Bremen Fire Insurance Co., Lynchburg, Va.
Mr. H. E. Marks, Treasurer, Steel Fireproofing Co., Wheeling, W. Va.
J. C. McFarland & Co., 27th St. and Fifth Ave., Chicago, Ill.
The Niagara Falls Power Company, Niagara Falls, N. Y.
Oneida Community, Limited, Oneida, N. Y.
Perkinson & Brown, 412–414 N. Lincoln St., Chicago, Ill.
Mr. John F. Ruth, 4299 Eastern Ave., St. Louis, Mo.
Mr. Austin M. Everett, The Roebling Construction Co., 1017–1018 Crocker Building, San Francisco, Cal.

SEPTEMBER, 1909.

Associate.

Mr. John Bergen, Royal Fire Insurance Co., Ltd., 84 Wiiliam St., New York, N. Y.
Mr. Charles R. Brown, Agent, Home Insurance Co., Galveston, Texas.
Mr. William T. Mills, Jr., Royal Fire Insurance Co., Ltd., 84 William St., New York, N. Y.
Mr. A. A. Mondou, Manager, The Strathcona Fire Insurance Co., Pierreville, P. Q.

Subscribing.

Barr & Anderson, Sprinkler Equipments. 114 Hastings St. W., Vancouver, B. C.
Mr. G. W. Brown, Contractor, 1135 14th St., Denver, Col.
Independence Inspection Bureau, 137 S. Fifth St , Philadelphia, Pa.
Mr. J. C. Jurgensen, Chief Dept. Economics, Abraham & Straus, 29 W. 97th St., New York, N. Y.
New England Tank & Tower Co., 112 High St., Boston, Mass.
Standard Extinguisher Co., W. H. Banfil, Manager, 78 Portland St., Boston, Mass.
Mr. John G. Sutton, John G. Sutton Co., 229 Minna St., San Francisco, Cal.

Specifications, Rules and Requirements

PUBLISHED BY THE

National Board of Fire Underwriters

UPON RECOMMENDATION OF

THE NATIONAL FIRE PROTECTION ASSOCIATION, THE CONSULTING ENGINEERS, AND THE UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION.

SUBJECTS.	Last edition
Acetylene Gas Machines and Storage of Calcium Carbide	1908
Coal Gas Producers (pressure and suction systems)	1908
Electric Wiring and Apparatus (National Electrical Code)	1907
Electrical Fittings, List of Approved	April, 1909
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Fire Extinguishers, Chemical (for other than fire department use)	1909
Fire Hose, Unlined Linen, for use inside buildings	1909
Fire Pumps (steam)	1908
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Gasolene Vapor Gas Lighting Machines, Lamps and Systems	1906
Gasolene Vapor Stoves, for cooking and heating	1903
Grain Dryers	1901
Hose Couplings and Hydrant Fittings, for public fire service	1908
Hose Houses, for mill yards	1905
Incubators and Brooders	1908
Kerosene Oil Pressure Systems	1902
Lightning, Protection Against	1907
Oil Storage (fuel), storage and use of fuel oil and construction and installation of oil burning equipment	1902
Oil Storage (inflammable), systems for storing 250 gallons or less of fluids which at ordinary temperatures give off inflammable vapors	1904
Railway Car Houses (storage and operating), Construction and Protection of	1907
Signaling Sytems, used for the transmission of signals affecting the fire hazard	1907
Skylights	1906
Sprinkler Equipments, automatic and open systems	1905
Steam Pump Governors and Auxiliary Pumps	1908
Uniform Requirements ("slow-burning" construction, "superior" construction, general hazards, oil rooms, general protection, stairway and elevator closures, watchmen, thermostats, etc.)	1906
Waste Cans, Ash Cans, Refuse Barrels, Fire Pails and Safety Cans for Benzine and Gasolene	1903
Wired Glass and Metal Window Frame Construction	1905
" " " " " " " (supplement)	1906
Underwriters' Laboratories, general information in reference to the nature of its work and the terms and conditions under which tests of fire appliances and materials are conducted	1909

A copy of each revised edition of the above pamphlets is mailed to members of the National Fire Protection Association on publication. Members desiring additional copies may obtain the same, without charge, by addressing the Secretary.

Approved Devices and Materials.

There are listed below in form convenient for reference by members the names and addresses of manufacturers of devices and materials which have thus far been favorably passed upon by the Devices and Materials Committee, following examinations, tests and recommendations made by Underwriters' Laboratories, Inc.

The Laboratories have also issued reports giving ratings unfavorable to a large number of appliances. A summary of the findings in each case can be obtained by addressing the Laboratories and any Active or Associate member can receive regularly the cards issued by the Laboratories giving summaries of the results obtained in the current work in all of its departments upon payment of the subscription price of fifteen dollars ($15) per year.

In the lists which follow members should note particularly that in those industries to which the label service has been extended (indicating inspection of goods by Laboratories' engineers at factories before shipment) **only such of the product of these factories as bear the labels referred to** are covered by the endorsement of the Committee.

BUILDING MATERIAL.

Post Cap and Girder Support (Steel and Malleable Iron.)

Caps inspected at factory bear above structural material labels attached to an exposed side.

The following companies are equipped to supply these devices:

Chicago, A. M. Castle & Co., 217–221 N. Jefferson Street.
Cleveland, The Duplex Hanger Co.

Asbestos Building Lumber.

Asbestos Lumber manufactured by the following company is considered from the insurance viewpoint as superior to wood for the uses intended.

Ambler, Pa., Keasby & Mattison.

Sagax Wood.

Made of ground straw, a cement binder and a few other ingredients, the exact composition being regarded as a trade secret.

Laboratory tests indicate that this material is non-combustible, a good non-conductor of heat, and when made in large sections of sufficient thickness is only slightly injured by high temperatures and the subsequent application of water. It absorbs moisture slowly, is considerably heavier and more brittle than wood and can be worked with ordinary wood-working tools.

The following company manufactures this material:

Baltimore, Md., Sagax Wood Co.

Wall Hanger (Steel).

Hangers inspected at factory bear above structural material labels attached to an exposed side.

The following company is equipped to supply this device:

Cleveland, Ohio, The Duplex Hanger Co.

CARBONIC ACID GAS HAND FIRE EXTINGUISHERS, 3 Gallons.

Carbonic Acid Gas Hand Fire Extinguishers shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with the rules of the National Fire Protection Association and examined and tested at factories and passed by Underwriters' Laboratories, Inc., have metal label soldered to the front of the cylinder, reading:

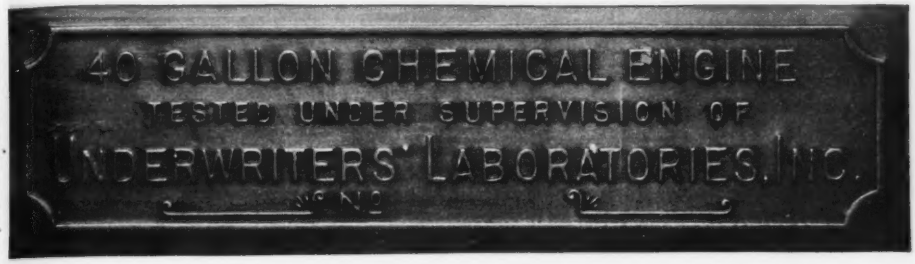
The following companies are equipped to supply these devices:

Boston, Badger Fire Extinguisher Co., 32 Portland Street.
Boston, Knight & Thomas, Inc., 99 State Street.
Buffalo, Western Inspection Co., 45 N. Division Street.
Chicago, Miller Chemical Engine Co., 220–222 W. Huron Street.
Chicago, Staff Fire Extinguisher Co., 543-545 Orleans Street.
Cincinnati, Harker Mfg. Co., 118 W. Second St.
Columbus, Seagrave Company, South High Street.
Elmira, N. Y., American-LaFrance Fire Engine Co.
Minneapolis, Minn., Northern Fire Apparatus Co., 1301–1307 Third Street, South.
Montreal, Can., The Garth Co., 26–32 Craig Street, West.
Newark, N. J., The Tea Tray Company of Newark, N. J., Mulberry and Murray Streets.
New York, Metropolitan Fire Extinguisher Co., 1133 Broadway.
Petrolia, Ont., Canada, Stempel Mfg. Co., Ltd.
Philadelphia, James Boyd & Bro., 14 North Fourth Street.
Pittsburg, Fire Extinguisher & Supply Co., 1414–1422 Spring Garden Avenue, N. S.
Pittsburg, Pittsburg Lamp, Brass & Glass Co.
Racine, Wis., Racine Iron & Wire Works, 1022 Douglas Avenue.

St. Louis, Frank & St. Gemme Mfg. Co., 815–817 Market Street.
St. Louis, Missouri Lamp and Mfg. Co., 116 Elm Street.
St. Louis, Stempel Fire Extinguisher Co., 4250 North 20th Street.
Toronto, Canada, Victor Fire Extinguisher Company, 704 Continental Life Building.
Utica, O. J. Childs Co., 50 Liberty Street.

CARBONIC ACID GAS FIRE EXTINGUISHERS, 40 Gallons.

Carbonic Acid Gas Fire Extinguishers of 40 gallons capacity mounted on wheels, shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association and examined and tested at factories and passed by Underwriters' Laboratories, Inc., have metal label soldered to the front of the cylinder reading:



The following companies are equipped to supply these devices:

Boston, Badger Fire Extinguisher Co., 32 Portland Street.
Elmira, N. Y., American-LaFrance Fire Engine Co.

DOORS AND SHUTTERS
for Openings in Fire Walls.

Tin-Clad Fire Doors and Shutters.

Standard Tin-Clad Fire Doors, shown by tests and examinations conducted by Underwriters' Laboratories, to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by stamping in the tin plates or by attaching brass labels, reading:

The following companies are equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installations are made.

Akron, O., The Kasch Roofing Co., 16-24 Canal Street.
Atlanta, Ga., Dowman-Dozier Mfg. Co., 20-22 Trinity Avenue.
Aurora, Ill., National Fire Door Co.
Brooklyn, Hiram A. Akerly, 173 Berry Street.
Buffalo, Chas. Bauers' Sons, 159 William Street.
Buffalo, Philip Christmann & Sons, Corner Virginia and Orange Streets.
Buffalo, Dusing & Hunt, 76 Main Street.
Buffalo, Machwirth Bros. Co., 201–209 Oak Street.
Buffalo, G. H. Peters & Co., 289–293 Oak Street.
Chicago, J. L. Lyon, 1743 Walnut Street.
Chicago, J. C. McFarland & Co., 27th Street and Fifth Avenue.
Chicago, Variety Mfg. Co., Carroll and Sacramento Avenues.
Cincinnati, J. H. Shields, 231 Sycamore Street.
Cleveland, J. Callaghan & Son, 1119 Superior Avenue, near Twelfth Street, N. E.
Cleveland, Cleveland Metal Roofing & Ceiling Co., 3103–3105 Detroit Avenue.
Cleveland, Cleveland Sheet Metal Works, 6933–5 Superior Avenue.
Cleveland, Mannen & Esterly Co., 2241–2255 St. Clair Avenue, N. E.
Cleveland, The O'Donnell Safety System Co., 3062 Superior Avenue, N. E.
Cleveland, The Ohio Roofing Co., 1477 Euclid Avenue.
Cleveland, Riester & Thesmacher Co., 325–329 Pearl Street.
Cleveland, Rudolph & Sons Co., 1416–1420 Prospect Avenue, N. W.
Columbus, Kinnear & Gager Mfg. Co., 326 Mt. Vernon Avenue.
Columbus, National Fire Equipment Co., 192 E. Long Street.
Hoboken, N. J., Leonard Sheet Metal Works, 215–221 Grand Street
Holyoke, Mass., Coburn Trolley Track Manufacturing Co.
Kansas City, Geo. W. Johnson Mfg. Co., 209–11 W. 17th Street.
Milwaukee, Biersach & Niedermeyer Co., 220 Fifth Street.
Milwaukee, Consolidated Sheet Metal Works, 661–673 Hubbard Street.
Minneapolis, Stremel Bros. Roofing & Cornice Co., 1215–1219 Washington Avenue, North.
Minneapolis, Variety Fire Door Co., 123 Western Avenue.
Newburyport, Mass., Victor Manufacturing Co.
New Orleans, American Sheet Metal Works, Carrollton Avenue and Edinburgh Street.
New Orleans, Estate of R. G. Holtzer, 317–323 Burgundy Street.
New Orleans, A. J. Nelson Manufacturing Co., Ltd.
New Orleans, New Orleans Roofing and Metal Works, Scott, Toulouse, St. Louis Sts., and Carrollton Avenue.
New York, J. F. Blanchard Co., 23d and Broadway.
New York, Howell & Lawrence, 1788 First Avenue.
New York, Kusburn Co., 27 East 22d Street.
New York, Manhattan Fireproof Door Co., 412–422 E. 125th Street.
New York, John W. Rapp, 1 Madison Avenue.
New York, M. F. Westergren, Inc., 213–221 E. 144th Street.
Philadelphia, David Luptons Sons Co., Allegheny Avenue and Tulip Street.
Philadelphia, The J. S. Thorn Co., 20th and Allegheny Avenue.
Richmond, Ind., Richmond Safety Gate Co.
San Francisco, Rulofson Metal Window Works, 315–319 Monadnock Building.
St. Louis, Albert & Fischer Hardware & Sheet Metal Co., 2529 South Broadway.
St. Louis, Caplan Galvanized Iron Cornice Co., 4412-4414 Easton Avenue.
St. Louis, J. Eberle & Son, 2014–2016 Laclede Avenue.
St. Louis, Gerock Bros. Mfg. Co., 1352 Old Manchester Road.
St. Louis, O. K. Harry Steel Works, 2333–5 Papin Street.
St. Louis, Frank B. Higgins, 924 North Sixth Street.
St. Louis, Hopmann Cornice Co., 2500–2 North Jefferson Avenue.
St. Louis, Mesker & Bro., 421-519 S. Sixth Street.
St. Louis, Missouri Fire Door Co., 100 South Commercial Street.
St. Louis, E. Murphy & Co., 3727–3731 Easton Avenue.
St. Louis, Powers & Boyd Cornice and Roofing Co., 3614–16 Laclede Avenue.
St. Louis, Richmond Safety Gate Co., 1117 Chemical Building.
St. Louis, Ruth Cornice Co., 4299 Easton Avenue.
St. Louis, St. Louis Fire Door Co., Cass and Collins Streets.

St. Louis, E. E. Souther Iron Co., 2206 North Second Street.
St. Louis, Standard Fire Door and Contracting Co., 3025 Texas Avenue.
St. Louis, Van der Au & Cluss Mfg. Co., 2408 So. Jefferson Avenue.
St. Louis, Wand & Niehaus, 3008 Kossuth Avenue.
St. Louis, West End Cornice Works, 4740 Delmar Avenue.
St. Paul, Perkins Mfg. Co., Corner Fairview and University Avenues.
West New York, N. J., A. J. Ellis.
Toledo, O., The C. F. Burdick Co., 2011 Adams Street.
Toledo, O., J. L. Creswell, 120 N. St. Clair Street.
Toronto, Ont., Can., Douglas Brothers, 124 Adelaide Street, West.
Toronto, Ont., Can., A. B. Ormsby, Ltd., 161–165 Queen Street, East.

Metal Fire Doors and Shutters.

Three-inch fire door, made of No. 24 U. S. gage crimped galvanized steel in horizontal sections 8 inches wide filled with mineral fibre.

Doors of this type shown by tests and examinations conducted by Underwriters' Laboratories to be the equivalent of the standard 2 1-2-inch fire door for openings **not exceeding 80 square feet in area** and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by stamping in the plates or attaching brass labels, as shown above.

The following company is equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Philadelphia, David Luptons Sons Co., Allegheny Avenue and Tulip Street.

Metal Fire Doors.

Two and one-half-inch fire door, made of No. 26 gage steel, galvanized, in horizontal sections 8 inches wide, filled with mineral fibre.

Doors of this type shown by tests and examinations conducted by Underwriters' Laboratories to be the equivalent of the standard 2 1-2-inch fire door for openings **not exceeding 80 square feet in area** and examined at factories and passed by Underwriters' Laboratories, nc., are labeled by stamping in the plates or attaching brass labels, as shown above.

The following company is equipped to supply these doors. Underwriters having jurisdiction should be consulted in all cases before installations are made.

Columbus, Ohio, Kinnear Manufacturing Co.

Door made of two thicknesses No. 22 U. S. gage corrugated galvanized sheet steel, with 1-16-inch sheet asbestos between. Corrugated steel sheets on opposite sides of door are bolted and riveted together only at edges. Doors stiffened by flat bars and galvanized iron channels at edges.

Doors of this type shown by tests and examinations conducted by the Underwriters' Laboratories to be the equivalent of the standard 2 1-2-inch fire door for openings **not exceeding six feet in width** and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by attaching brasslabel shown above.

The following company is equipped to supply these doors. Underwriters having jurisdiction should be consulted in all cases before installations are made.

Memphis, Tenn., Saino Fire Door & Shutter Co., Tennessee Trust Building.

Composition Fire Doors.

Two-inch solid door made of Sagax wood reinforced by $\frac{1}{2}$-inch round steel rods in both directions, located in middle of door, rods interlaced and extend close to edges of door. Vertical rods spaced not exceeding 4 inches and twisted around 1-4-inch horizontal rod at top. Horizontal rods spaced not exceeding 6 inches.

Doors of this type shown by tests and examinations conducted by the Underwriters' Laboratories to be the equivalent of the standard tin-clad door for openings **not exceeding 80 square feet in area** and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by attaching brass label shown above.

The following company is equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Baltimore, Md., The Sagax Wood Co., 106 Dover Street.

Double Steel Rolling Fire Doors.

For openings not exceeding 8 feet wide and 9 feet high where standard fire doors cannot be employed.

Doors examined at factory and passed by Underwriters' Laboratories, Inc., have labels attached to the bottom bar reading:

The following company is equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Columbus, O., Kinnear Mfg. Co., Marking, "Abacus No. 3."

Steel Rolling Fire Shutters.

For exterior openings not exceeding 10 feet wide and 10 feet high.

Shutters examined at factory and passed by Underwriters' Laboratories, Inc., have labels attached to the bottom bar as shown above.

The following company is equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Columbus, O., Kinnear Mfg. Co., Marking, "Abacus No. 4."

CORRIDOR OR PARTITION DOORS

Not for Openings in Fire Walls.

Doors shown by tests and examinations conducted by Underwriters' Laboratories, Inc., to possess sufficient fire retardant value to warrant approval in corridors and partitions but **not for openings in fire walls** (see list of Fire Doors and Shutters) and examined at factories and passed by Underwriters' Laboratories, Inc., bear etched brass labels attached to the back edge reading:

The following companies are equipped to supply these devices in the types indicated:

Metallic Doors.

Chicago, Knisely Bros., 5th Avenue and 28th Place. 2-inch door, frame, trim.
Chicago, Voigtmann & Co., 445–449 West Erie Street. 2-inch door, frame, trim.
Jamestown, N. Y., American Metal Door Co., Jamestown. 1⅜-inch door, frame, trim.
Jamestown, N. Y., Art Metal Construction Co.
Jamestown, N. Y., Dahlstrom Metallic Door Co., Jamestown. 1½-inch door, frame, trim.
Minneapolis, Northwestern Roofing, Cornice & Stamping Works, 1113 S. Fifth Street. 2-inch door, frame, trim.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 1 13-16-inch door. Door only.
New York, John W. Rapp, 1 Madison Avenue. 1¾-inch door, frame, trim.
Youngstown, O., General Fireproofing Co., Youngstown. 2-inch door, frame, trim.

Metal Clad Doors.

Chicago, Knisely Bros., 5th Avenue and 28th Place. 2-inch door only.
Minneapolis, Thorp Fireproof Door Co., 1600–1616 Central Avenue. 1⅞-inch door, frame, trim.
Minneapolis, Thorp Fireproof Door Co., 1600-1616 Central Avenue. 2⅛-inch door, frame, trim.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 1⅝-inch door only.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 2⅛-inch door only.
New York, Howell & Lawrence, 1788 First Avenue, 1⅝-inch door only.
New York, Manhattan Fireproof Door Co., 412-422 E. 125th Street. 1⅞-inch door only. Known as "Standard A."
New York, Manhattan Fireproof Door Co., 412-422 E. 125th Street. 1⅝-inch door only. Known as "Standard B."

Composition Doors.

Baltimore, Md., Sagax Wood Co., 106 Dover Street. 1¾-inch door and frame. Known as "Perfection."

STAIR OR ELEVATOR DOORS

Not for Openings in Fire Walls.

Doors shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by labels screwed or riveted to the edge of the door reading:

The following companies are equipped to supply these devices:

Chicago, Knisely Bros., 28th Place and 5th Avenue.
Chicago, Variety Mfg. Co.
Chicago, Voigtmann & Co., 445–449 West Erie Street.
Columbus, O. The Kinnear Mfg. Co.
Jamestown, N. Y., American Metal Door Co.
Jamestown, N. Y., Art Metal Construction Co.
Jamestown, N. Y., Dahlstrom Metallic Door Co.
Minneapolis, Northwestern Roofing, Cornice and Stamping Works, 1113 S. Fifth Street.
Minneapolis, Thorp Fireproof Door Co., 1600–1616 Central Avenue.
New York, J. F. Blanchard Co., Broadway and 23d Street.
New York, Howell & Lawrence, 1788 First Avenue.
New York, Manhattan Fire Proof Door Co., 412–422 E. 125th Street.
New York, John W. Rapp, 1 Madison Avenue.
Youngstown, O., General Fireproofing Co.

DOOR AND SHUTTER HARDWARE.

Standard $3\frac{1}{2}$x$\frac{8}{8}$-inch hardware for sliding doors only, shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by approved name and issue mark on each piece in the set and by labels applied to each hanger, binder and stay roll reading as follows:

A tag is also attached to one hanger of each set on which is printed a list of the pieces which a complete set should contain, as follows:

1. One $3\frac{1}{2}$x$\frac{3}{4}$-inch track, length to be equal to twice the width of the door opening, plus 21 inches. Punched for wall bolts. 2. Two hangers for openings six feet and less in width; three hangers for openings wider than six feet. Bolts for attaching hangers to door. 3. Two $3\frac{1}{2}$x$\frac{3}{4}$-inch binders. 4. One $2\frac{1}{2}$x$\frac{1}{2}$-inch stay roll. Stay roll should be the type specified for the form of sill used and should include all bolts except wall bolts. 5. One cast-iron bracket for each track bolt. 6. Two $\frac{3}{4}$x$\frac{1}{4}$-inch half oval chafing strips for back of door, two 1x$\frac{1}{8}$-inch flat strips for front of door opposite the oval strips. Bolts for fastening above strips together through door. Length of above strips to be 4 inches less than door opening. 7. One $1\frac{1}{2}$x$\frac{1}{8}$-inch strip 5 inches less than width of door to take wear of stay roll. Wood screws for attaching. 8. One wedge with screws for attaching. 9. One bow-shaped handle and one flush pull with bolts and screws for attaching. 10. One front bumper and one back bumper. 11. Four bumper shoes and screws for attaching. 12. One washer for each wall bolt, including those for binders and stay roll. 13. One instruction card for mounting.

Where the hardware for a single fire door on each side of the fire wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length vary in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following companies are equipped to supply this hardware:

Aurora, Ill., Richards Mfg. Co. Marking, "Monarch A."
Aurora, Ill., Wilcox Mfg. Co. Marking, "Wilcox 501–A."
Cleveland, O'Donnell Safety System Co., Corner Superior Avenue and 31st Street, N. E. Marking, "O'Donnell A."
Chicago, Variety Mfg. Co., Carroll and Sacramento Avenues. Marking, "Variety A."
Holyoke, Mass., Coburn Trolley Track Mfg. Co. Marking, "Coburn A."
Newburyport, Mass., Victor Mfg. Co. Marking, "Victor A."
New York, The McCabe Hanger Mfg. Co., 425–427 W. 25th Street. Marking, "'A' McCabe."
Philadelphia, Jas. Peters & Son, 1934–38 N. Front Street. Marking, "Peters A."
Richmond, Richmond Safety Gate Co. Marking, "A. Richmond."
South Milwaukee, Wis., Stowell Manufacturing & Foundry Co. Marking, "No. 20–A Wilbern."
St. Louis, Mesker & Bro., 421-519 South Sixth Street. Marking, "Mesker & Bro. 'A'."

Specially designed malleable iron hardware for sliding fire doors, which is considered to be the full equivalent of the $3\frac{1}{2}$x$\frac{3}{8}$-inch steel hardware made in accordance with the requirements of the National Board of Fire Underwriters and examined at factories and passed by Underwriters' Laboratories, Inc., may be distinguished by approved name and issue mark on each piece in the set and by labels applied to each hanger, binder and stay roll as shown above.

A special tag is attached to one hanger of each set on which is printed a list of the pieces which a complete set should contain as follows:

1. One 1 7-16-inch tubular track, length to be equal to twice the width of door opening, plus 14 inches. 2. Two hangers for openings six feet and less in width, three hangers for openings wider than six feet, and bolts for attaching hangers to door. 3. Two malleable iron binders. 4. One malleable iron stay roll. 5. Brackets to carry track, including two special end supports. 6. Two $\frac{3}{4}$x$\frac{1}{4}$-inch half oval chafing strips for back of door, two flat strips for front of door opposite the oval strips. Bolts for fastening above strips together through the door. Length of above strips to be 4 inches less than door opening. 7. One $1\frac{1}{2}$x$\frac{1}{8}$-inch strip 5 inches less than width of door to take wear off stay roll, with wood screws for attaching. 8. One malleable iron wedge with screws for attaching. 9. One bow-shaped handle and one flush pull with bolts and screws for attaching. 10. One front bumper and one back bumper. 11. Four bumper shoes and screws for attaching. 12. One washer for each wall bolt, including those for binders, bumpers and stay roll.

Where the hardware for a single fire door on each side of the fire wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length vary in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following companies are equipped to supply this hardware:

Chicago, Allith Manufacturing Co., Taylor Street and 43d Avenue. Marking, "Allith A-06."
Hamilton, Can., Allith Mfg. Co. Marking, "Allith H."

Specially designed malleable iron hangers, tubular steel track and malleable iron brackets for sliding fire doors, which are considered to be the full equivalent of 3½x⅝-inch steel hardware made in accordance with the requirements of the National Board of Fire Underwriters, approved in combination with the balance of the set of standard 3½x⅝-inch steel hardware and examined at factory and passed by Underwriters' Laboratories, Inc., can be distinguished by approved name and issue mark on each piece in the set and by labels applied to each hanger, binder and stay roll as shown above.

A special tag is attached to one hanger of each set on which is printed a list of pieces which a complete set should contain as follows:

1. One 1¾-inch tubular steel track, length to be equal to twice the width of the door opening plus 14 inches. 2. Two hangers for openings six feet and less in width; three hangers for openings wider than six feet. Bolts for attaching hangers to door. 3. Two 3½x¾-inch binders. 4. One 2½x⅛-inch stay roll. Stay roll should be the type specified for the form of sill used, and should be provided with all bolts except wall bolts. 5. Malleable iron brackets for carrying track, including two special end supports, which are also designed to act as front and back bumpers, respectively. 6. Two ¾x¼-inch half oval chafing strips for back of door; two flat strips for front of door opposite chafing strips. Bolts for fastening strips together through door. Length of above strips to be 4 inches less than door opening. 7. One 1¾x⅛-inch strip 5 inches less than width of door. Wood screws for attaching. 8. One wedge with screws for attaching. 9. One bow-shaped handle and one flush pull with bolts for attaching. 10. Four bumper shoes and screws for attaching. [Note: Each bumper shoe made in two parts.] 11. Four bumper shoes and screws for attaching. 12. One washer for each wall bolt, including those for binders, bumpers and stay roll. 13. One instruction card for mounting.

Where the hardware for a single fire door on each side of the fire wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length vary in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following company is equipped to supply this hardware:

Aurora, Ill., Wilcox Manufacturing Co. Marking, "Wilcox No. 645."

HANGERS ONLY.

Specially designed adjustable malleable iron hanger for sliding fire doors. Approved only in combination with a complete set of approved fixtures for sliding doors, and in locations where an adjustable hanger is acceptable to Underwriters having jurisdiction. Hangers examined at factory and passed by Underwriters' Laboratories, Inc., may be distinguished by approved name and issue mark and by labels shown above.

The following company is equipped to supply this hardware:

South Milwaukee, Wis., Stowell Manufacturing & Foundry Co. Marking, "Wilbern No. 4A."

EXTINGUISHER, Miscellaneous.

Waggoner Sanatory Fire Bucket.

This pail as submitted complied with the National Fire Protection Association rules in details of construction and was designed in a manner which effectually protects its contents from evaporation and foreign matter.

Where it is desired to protect the contents of exposed pails against freezing by the addition of calcium chloride or other salts underwriters having jurisdiction should be consulted.

The following company manufactures this bucket:

Chicago, Ill., Waggoner Sanatory Fire Bucket Co., 1340 Lake St.

FIRE DOORS. (See Doors and Shutters.)

FUSIBLE LINK.

The fusible link manufactured by the following company for use in connection with automatic closing devices for doors and windows, and automatic devices requiring fusible links where the loads to which the link is subjected do not exceed the following:

5 lbs. where a factor of safety of 5 is required.
6 1-4 lbs. where a factor of safety of 4 is required.
8 1-3 lbs. where a factor of safety of 3 is required.

is approved.
Chicago, Voigtmann & Co., 445–449 W. Erie Street.

GLASS. (See Wired Glass.)

HARDWARE. (See Door and Shutter Hardware; also Window Hardware.)

HEAT INSULATING COVERINGS.

The following material is approved for heat insulating purposes for walls, floors and ceilings in cold storage warehouses, cold storage cellars in breweries, cold rooms in packing houses, hotel refrigerators, fur storage rooms and rooms of this character.

Cork Board (Nonpareil) laid in cement mortar. Manufactured by Armstrong Cork Co., Pittsburg, Pa.

HOSE.

2½ Inch Cotton Rubber-Lined.

Private Fire Department Hose for outside use shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by red rubber label attached to each 50 foot length with couplings attached reading :

And by slate colored label attached to each 50 foot length without couplings reading : —

The following companies are equipped to supply this material :

Akron, O., B. F. Goodrich Co.
Boston, Mass., Boston Woven Hose and Rubber Co.
New York, Fabric Fire Hose Co., Corner Duane and Church Streets.
New York, Manhattan Rubber Mfg. Co., 18 Vesey Street.

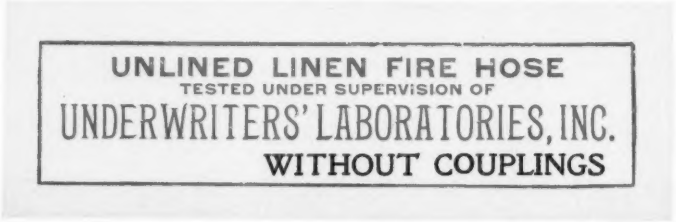
Before the extension of the label service to this industry approvals were granted to certain brands of hose manufactured by the foregoing and other companies as follows :

American, Boston Belting Co., 256 Devonshire Street, Boston, Mass.
G. P., Gutta Percha and Rubber Mfg. Co., 126 Duane Street, New York.
Guttaperch, Gutta Percha and Rubber Mfg. Co. of Toronto, Ltd., 47 Yonge Street Toronto, Ont.
Star, Canadian Rubber Co., Notre Dame Street and Papineau Avenue, Montreal, Can.
Tuebor, New Jersey Car Spring and Rubber Co., Wayne and Brunswick Streets, Jersey City, N. J.
2-X-L, Mechanical Rubber Co., Cleveland, O.
U. S., Eureka Fire Hose Mfg. Co., 13 Barclay Street, New York.

Unlined Linen.

Unlined Linen Fire Hose for use inside buildings shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by label attached to each length **with couplings attached** reading as follows:

And by label attached to each length **without couplings** reading:



The following companies are equipped to supply this material:

Boston, Mass., Boston Woven Hose and Rubber Co.
Lawrence, Mass., Wm. and Chas. Beck.
Malden, Mass., Chas. Niedner's Sons Co., 10–20 James Street.
New York, Eureka Fire Hose Mfg. Co., 13 Barclay Street.

HYDRANTS.

The hydrant manufactured by the following company has been examined and tested and pending the adoption of revised specifications for construction of devices of this class is recommended for use in connection with mill yard and other private underground fire mains. Service record generally satisfactory.

Indian Orchard, Mass. Chapman Valve Mfg. Co.

PAINTS, FIRE RETARDANT.

These coatings for wood and other similarly combustible building materials which come under this class, or property so coated, should in no sense be considered as "fireproof." Their use is preferable to leaving the material uncoated because they retard the spread of fire over combustible surfaces and are particularly desirable in lieu of varnish, shellac, or oil finish, which latter serve to rapidly spread fire. Attention is called, however, to the need of renewal of the coatings in order to maintain the desired conditions.

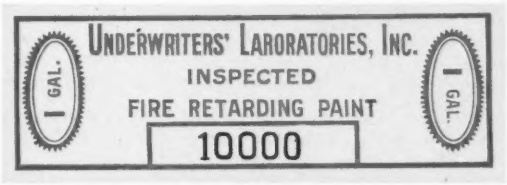
Whitewash so well meets the requirements of this class that we print formula recommended by the Lighthouse Board of the United States Treasury Department as follows:

"Slake one-half bushel of unslaked lime with boiling water, keeping it covered during the process; strain it and add a peck of salt dissolved in warm water; three pounds of ground rice, put in boiling water and boil to a thin paste; one-half pound powdered Spanish whiting and a pound of clear glue dissolved in hot water; mix these well together and let the mixture stand for several days. Keep the wash thus prepared in a kettle or portable furnace and when used put it on as hot as possible with painter's or whitewash brushes."

Where possible the coatings should be applied by a hand brush rather than by a spraying machine, thus effecting a better surface, and special care should be exercised not to coat sprinkler heads where installed.

Bay State Brick and Cement Coating. Manufactured by Wadsworth, Howland & Co., 82–84 Washington Street, Boston, Mass.

This coating is put up in cans and barrels and sold as a ready-mixed paint. The product examined at the factory and passed by Underwriters' Laboratories, Inc., can be distinguished by label attached to each container reading as follows:



The so-called "cold water" paints listed below have been examined and tested.

Asbestine. Manufactured by The Muralo Co., New Brighton, S. I., N. Y.

Carey's. Manufactured by The Neptune Paint Co., Hudson, Mich., for The Philip Carey Mfg. Co., Cincinnati, O.

Decorine. Manufactured by Benj. Moore & Co., 401–409 N. Green Street, Chicago.

Fox Interior Permanite. M. Ewing Fox & Co., 136th Street and Rider Avenue, New York, N. Y.

Hygienic Fireproof Calcimine. Manufactured by The Rubber Paint Co., 154 W. Van Buren Street, Chicago.

Indeliblo. Manufactured by The Muralo Co., New Brighton, S. I., N. Y.

Indurine. Manufactured by The Muralo Co., New Brighton, S. I., N. Y.

J. M. Manufactured by The Neptune Paint Co., Hudson, Mich., for H. W. Johns-Manville Co., Milwaukee, Wis.

Monarch. Manufactured by Geo. Fletcher & Co., 324 N. Ashland Avenue, Chicago.

Nepolite. Manufactured by The Neptune Paint Co., Hudson, Mich.

Retardo. Manufactured by Benj. Moore & Co., Chicago, for Retardo Fire Proof Paint Co. Milwaukee, Wis.

U. S. G. United States Gypsum Co., Chicago.

PLAY PIPE.

The National Standard Play Pipe for 2½ inch hose manufactured by the following manufacturer has been examined and tested and approved for use:

New York, Eureka Fire Hose Manufacturing Co., 13 Barclay Street.

PUMPS.

National Standard Steam Fire Pump, 1,000 Gallon Size.

The first pump of this character built by the following manufacturer has been examined and tested, and is in all essential particulars in compliance with National Standard specifications. The manufacturers' test facilities, however, are inadequate for test of pumps of this size, and improvement in this respect and further tests of later pumps when built have been recommended.

Battle Creek, Mich., Advance Pump and Compressor Co.

PUMP GOVERNORS.

Salem, Mass., Locke Regulator Co.

ROOFINGS.

Certain proprietary roofings listed below have been examined and tested.

These tests indicate that the fire retardant properties of these materials are inferior to those of slate, metal or good tin-clad roofs, but in a class with those of good slag and good gravel roofs, and superior to those of wooden shingle roofs.

Armco (Prepared, 2 ply), All Roofing Manufacturing Co., East St. Louis, Ill.
Arrow Brand Asphalt Ready Roofing (Prepared, 2 ply), Asphalt Ready Roofing Co., 136 Water Street, New York.
Amatite (Prepared), Barrett Manufacturing Co., 17 Battery Place, N. Y.
Amazon Ready Roofing (Prepared, 2 and 3 ply), Barrett Mfg. Co., Philadelphia. Pa.
Becker Asphaltum Ready Roofing (Prepared, 2 and 3 ply), F. Becker Asphaltum Ready Roofing Co., 1510-12 Milwaukee Avenue, Chicago, Ill.
Black Diamond (Prepared, 2 and 3 ply), Barrett Mfg. Co., 17 Battery Place, N. Y.
Carbonite (Prepared, 2 and 3 ply), The Heppes Co., 4500 Filmore Avenue, Chicago.
Carey's Standard Magnesia Flexible Cement (Prepared), The Philip Carey Mfg. Co., Lockland, Cincinnati, O.
Climax Asphalt (Prepared, 2 and 3 ply), McHenry-Millhouse Mfg. Co., South Bend, Ind.
Congo (Prepared, 2 and 3 ply), The Buchanan-Foster Co., 504 West End Trust Bldg., Philadelphia, Pa.
Crystalite (Prepared), National Roofing Co., Tonawanda, N. Y.
Diamond Grit (Prepared), National Roofing Co., Tonawanda, N. Y.
Eclipse Rubber (Prepared), Ford Manufacturing Co., Washington and Desplaines Street, Chicago, Ill.
Ehrets (Slag), Warren-Ehret Co., 1202 Land Title Bldg., Philadelphia.
Elaborated Ready (Prepared), Elaborated Ready Roofing Co., 4419 La Salle Street, Chicago.
Elaterite (Prepared), Western Elaterite Roofing Co., 841–4 Equitable Building, Denver, Col.
Flexo (Prepared, 2 and 3 ply), The Heppes Co., 4500 Filmore Avenue, Chicago.
Galvanized Rubber (Prepared), Ford Manufacturing Co., Washington and Desplaines Streets, Chicago, Ill.
Genasco (Prepared, Smooth Surface, 2 and 3 ply, Stone Surface, Whitestone and Model, 2 ply), The Barber Asphalt Paving Co., Philadelphia, Pa.
Granite (Prepared), The Eastern Granite Roofing Co., 1 Hudson Street, New York, N. Y.
Huttig Rubber (Prepared, 2 and 3 ply), Barber Asphalt Paving Co., 1243 Stock Exchange Bldg., Chicago, for Huttig Mfg. Co., Muscatine, Iowa.
Indruroid (Prepared, 2 and 3 ply), H. F. Watson Co., Erie, Pa.
Liberty (Prepared), National Roofing Co., Tonawanda, N. Y.
Lonabond (Prepared), Rubbertex Cloth & Paper Co., Commercial National Bank Bldg., Chicago.
Malthoid (Prepared, 2 and 3 ply), The Paraffine Paint Co., Merchants' Exchange Bldg., San Francisco, Cal.

Mastic (Prepared), National Mastic Roofing Co., San Francisco, and National Roofings and Materials Co., Edwardsville, Ill.
Mikado (Prepared, 2 and 3 ply), J. A. & W. Bird & Co., 35 India Street, Boston.
Monarch (Prepared, 2 and 3 ply), Stowell Mfg. Co., Jersey City, N. J.
National (Prepared), National Roofing Co., Tonawanda, N. Y.
No-Tar (Prepared, 2 and 3 ply), The Heppes Co, 4500 Filmore Avenue, Chicago.
Paroid (Prepared, 2 and 3 ply), F. W. Bird & Son, East Walpole, Mass.
Protection Brand Asphalt Ready Roofing (Prepared), Asphalt Ready Roofing Co., 136 Water Street, New York.
Reliance (Prepared, 2 and 3 ply), Sall Mountain Asbestos Mfg. Co., 7 North Canal St., Chicago.
Rex Flintkote (Prepared, 2 and 3 ply), J. A. & W. Bird & Co., 35 India Street, Boston.
Rhinoceros (Prepared, 2 and 3 ply), Warren Chemical and Manufacturing Co., 17 Battery Place, New York.
Roofbestos (Prepared, 2 and 3 ply), Roofbestos Mfg. Co., St. Louis, Mo.
Roofrite (Prepared), The Lehon Co., W. 43rd Street, Lincoln to Robey, Chicago.
Rubber (Prepared, 2 and 3 ply), The General Roofing Co., East St. Louis, Ill.
Rubbertex (Prepared, 2 and 3 ply), The Heppes Co., 4500 Filmore Avenue, Chicago.
Ruberoid (Prepared, 2 and 3 ply), Standard Paint Co., 100 William Street, New York.
Safety (Prepared), National Roofing Co., Tonawanda, N. Y.
Security (Prepared), National Roofing Co., Tonawanda, N. Y.
Sparkloid (Prepared, 2 and 3 ply), National Roofing Co., Tonawanda, N. Y.
Standard (Prepared), National Roofing Co., Tonawanda, N. Y.
Standard Asbestos (Prepared), H. W. Johns-Manville Co., 100 William Street, New York.
Stowell's Slag (Slag), Stowell Mfg. Co., Jersey City, N. J.
Usona (Prepared), Usona Mfg. Co., Aurora, Ill.
Veribest Rubber (Prepared, 2 and 3 ply), McHenry-Millhouse Mfg. Co., South Bend, Ind.
Vulcanite (Prepared, 2 and 3 ply), The Patent Vulcanite Roofing Co., 625 S. Campbell Avenue, Chicago.
Walrus (Prepared, 2 and 3 ply), Warren Chemical and Manufacturing Co., 17 Battery Place, New York.
West Coast Ready Rock (Prepared), The West Coast Company, Waukegan, Ill.

Shingles.

Winthrop Asphalt Shingles. Winthrop Asphalt Shingle Co., Chicago. **Rated as ordinary wooden shingles.**

SASH CHAIN. (See Window Hardware.)

SASH LOCK. (See Window Hardware.)

SHUTTERS. (See Doors.)

SPRINKLERS, Automatic.

It has not been judged necessary as yet to extend label service to these devices.

The following patterns are approved:

Crowder, issue A., Crowder Bros., 309 Merchants LaClede Bldg., St. Louis, Mo.
Grinnell Improved 1903. General Fire Extinguisher Co., Providence, R. I.
International, Evans 1902 Model. International Sprinkler Co., 517 Arch Street, Philadelphia, Pa.
Manufacturers "C." Manufacturers' Automatic Sprinkler Co., 1–11 Liberty Street, New York.
Neracher Improved 1902. General Fire Extinguisher Co., Providence, R. I.
Niagara-Hibbard, issue B, 1904. Niagara Fire Extinguisher Co., Akron, O.
Rockwood, issue A. Rockwood Sprinkler Co., 4 Arch Street, Worcester, Mass.

SPRINKLER SUPERVISORY DEVICES.

For use in connection with approved central station systems.

Consists of apparatus for transmitting signals when gate valves are closed or open; when water in tanks falls below or is restored to predetermined level; when pressure in air tanks falls below or is restored to predetermined amount; when water in tanks falls below or rises above predetermined temperatures. Also apparatus for connection with water flow valves to transmit water flow signals (where there is a flow of water equal to that of one or more sprinklers) and to withhold signals from water surges or variable pressure.

A. D. T. Devices for attaching to Central Station Signaling Systems for supervisory maintenance and operation of sprinkler equipments. Manufactured by Automatic Fire Protection Company, New York and Chicago.

THERMOSTATS.

"Aero" Automatic Fire Alarm.

The system utilizes the principle of the expansion under heat of air contained in a small copper tube which is installed along ceilings or piping. Tube leads to contact closing and test devices of special type. The expansion of air in tube actuates a diaphragm closing an electric circuit whereby signal is transmitted.

This device as sold by the following company is **approved** subject to the following conditions:

1. Underwriters having jurisdiction to be consulted in all cases before installations are made.
2. Tubing to be installed to comply as to location, distribution and spacing with requirements for thermostats of electric automatic fire alarms.
3. Central station equipments, local equipments, electric devices and circuits and other portions of this system other than the tubing and the pneumatic devices connected with it to comply in all respects with the requirements for similar portions of automatic fire alarm systems.
4. Labels. Tubing for this system constructed according to approved specifications and examined and tested at factory under the supervision of Underwriters' Laboratories, Inc., bears tag reading: "Underwriters' Laboratories, Inspected Tubing for Automatic Fire Alarm, No. . . . . ." One such tag for each 100 feet of tubing installed should be preserved in transmitter case at risk as permanent record of tubing used. Each Detector, Annunciator and Transmitter for this system constructed according to approved specifications and examined and tested at factory under supervision of Underwriters' Laboratories, Inc., bears metal label reading: "Underwriters' Laboratories, Inspected Automatic Fire Alarm Device, No. . . . . ."

Denver, Colorado, Frederick Thomas, Coronado Building, Agent for United States and Canada, for English Patentees.

VALVES, ALARM. (See also Sprinkler Supervisory Devices.)

No appliances meeting all of the requirements desirable for this service have as yet been shown.

Ratings covering the patterns found in common use have been issued as follows:—

Evans Variable Pressure 1902 model. Manufactured by International Sprinkler Co., 517 Arch Street, Philadelphia. Not standard. Field experience limited, but fairly satisfactory where device has been properly installed, correctly adjusted and intelligently supervised.

Grinnell English Pattern, Variable Pressure (Swing check or Straightway type). Manufactured by General Fire Extinguisher Co., Providence, R. I. Not standard. Field experience fairly satisfactory where device has been properly installed, correctly adjusted and intelligently supervised.

Grinnell branch (old type called Harkness Tee). Manufactured by General Fire Extinguisher Co., Providence, R. I. Not standard. Field experience, where central station and Local Board supervision obtains and valves are under constant pressure, reported as fairly satisfactory.

Manufacturers. Manufactured by Manufacturers' Automatic Sprinkler Co., 1–11 Liberty Street, New York. Not standard. Field experience with an improved type of this valve in one locality, where central station and Local Board supervision obtains and valves are under constant pressure, reported as fairly satisfactory.

Niagara. Manufactured by Niagara Fire Extinguisher Co., Akron, O. Not standard. Field experience with an improved type of this valve in one locality, where central station and Local Board supervision obtains and valves are under constant pressure, reported as fairly satisfactory.

VALVES, DRY PIPE.

The following dry pipe valves are approved for use:—

Grinnell Straightway. The General Fire Extinguisher Company, Providence, R. I.

International (No. 4 Evans Model), 4-inch and 6-inch sizes. International Sprinkler Co., Philadelphia, Pa.

Manufacturers (Model 3), 4-inch and 6-inch sizes. Manufacturers' Automatic Sprinkler Co., New York, N. Y.

Niagara (1909 Model), 4-inch and 6-inch sizes. Niagara Fire Extinguisher Co., Akron, O.

Rockwood, 4-inch and 6-inch sizes. Rockwood Sprinkler Co., Worcester, Mass.

WATCHMEN'S TIME RECORDING APPARATUS.

Boxes for Central Station Systems.

Combined Watchmen's Call and Fire Alarm Boxes for use in connection with approved normally closed circuit Central Station Watchmen's Time Recording Apparatus shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by labels fixed to the outside of the clock cases reading:—

The following companies are equipped to supply these devices:

American District Telegraph Co., 195 Broadway, New York.

Chicago Electric Protective Co., 147 Fifth Avenue, Chicago.

Signalphone Co., Milwaukee, Wis.

Viaduct Electric Co., 10 S. Howard Street, Baltimore, Md.

Williams Watchman's Clock Co., 608 Washington Loan and Trust Building, Washington, D. C.

Apparatus for Local or Private Systems.

Watchmen's Stationary Clocks shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by label fixed to outside of clock cases reading:

and a decalcomania transfer is applied to the outside of the magneto cases reading:

The following companies are equipped to supply these devices:

American Watchman's Time Detectors Co., 2069 Fourth Street, Cleveland, O.
American Watchman's Time Detectors Co., 234–5 Broadway, New York.
Eco Magneto Clock Co., 289 Congress Street, Boston.
E. A. Hamilton & Co., Grand Rapids, Mich.
E. O. Hausburg, 45 Maiden Lane, New York, N. Y.
Holtzer-Cabot Electric Co., Brookline, Boston, Mass.
E. Howard Clock Co., 373 Washington Street, Boston, Mass.
Newman Clock Co. (Single Station Clock), 1526 Wabash Avenue, Chicago.
Simplex Time Recorder Co., Gardner, Mass.
Standard Watchman's Time Detector Co. (W. Romaine), 1-3 W. Broadway, New York.

Before the extension of the label service to this industry approvals were granted to certain clocks manufactured by the foregoing and one other company as follows:
Wakeman's Single Station, Wakeman's Time Recorder Co., Scranton, Pa.

Portable Clocks.

Watchman's Portable Clocks shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by labels fixed to the inside of clock cases reading: (*Same as for stationary clocks shown above.*)

and a decalcomania transfer is applied to outside of the key boxes reading: (*Same as for magneto stations shown above.*)

The following companies are equipped to supply these devices:

Eco Magneto Clock Co., 289 Congress Street, Boston.
General Watchman's Time Detector Co., 27 Pine Street, New York, N. Y.
Hardinge Bros., 3135 Lincoln Avenue, Chicago.
E. O. Hausburg, 45 Maiden Lane, New York.
Nanz Clock Co., 178 Fulton Street, New York.
Newman Clock Co., 1526 Wabash Avenue, Chicago.
The Timekeeper Co., Chicago.

WINDOWS.

Metallic Window Frames and Sash for Wired Glass shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., have metal labels riveted to the inside of the window, reading:

The following companies are equipped to supply these devices:

Allegheny, Pa., Allegheny Cornice & Skylight Co., 821 Bouquet Street. Double Hung, Twin Double Hung.

Allegheny, Pa., Thos. W. Irwin Mfg. Co., 401–411 Rebecca Street. Double Hung.

Atlanta, Ga., Dowman-Dozier Mfg. Co., 20–22 Trinity Avenue. Double Hung.

Boston, E. B. Badger & Sons Co., 63 Pitts Street. Double Hung, Stationary (2 types), Pivoted Upper; Pivoted Upper and Lower; Pivoted Lower; Single Pivoted; Pivoted Upper and Double Hung Lower.

Boston, E. Van Noorden Co. Double Hung; Pivoted.

Brooklyn, Herrmann & Grace, 671–685 Bergen Street. Pivoted Upper Sash; Pivoted Upper and Lower; Fixed Upper; Pivoted Lower; Stationary.

Buffalo, Machwirth Bros. Co., 201–209 Oak Street. Pivoted Upper, Double Pivoted.

Chicago, Grace Cornice Works, 1260 Indiana Avenue. Double Hung.

Chicago, Illinois Roofing & Cornice Co., 1144–1146 Kinzie Street. Double Hung, Pivoted Upper Sash, Pivoted Lower Sash, Pivoted Upper and Lower Sash, Single Pivoted Sash, Stationary, Top Hinged Sash.

Chicago, Knisely Bros., Fifth Avenue and 28th Place. Casement Double Hung, Pivoted Upper Sash, Stationary, Pivoted Upper and Lower, Top Hinged, Single Pivoted; Fixed Upper and Pivoted Lower.

Chicago, Harry C. Knisely & Co. 506 S. Canal Street. Double Hung, Pivoted Upper Sash, Pivoted Upper and Lower Sash, Single Pivoted Sash, Stationary, Top Hinged, Pivoted Lower, Top Hinged Upper and Stationary Lower.

Chicago, J. C. McFarland & Co., 27th Street and Fifth Avenue. Casement Double Hung, Pivoted Upper Sash, Pivoted Upper and Lower Sash, Fixed Upper and Pivoted Lower Sash, Single Pivoted, Top Hinged, Stationary Lower and Top Hinged Upper Sash, Stationary.

Chicago, Jas. A. Miller & Bro., 114–116 S. Clinton Street. Double Hung, Pivoted Upper Sash, Stationary, Pivoted Lower, Pivoted Upper and Lower, Single Pivoted, Top Hinged.

Chicago, Perkinson & Brown, 412–414 N. Lincoln Street. Double Hung, Pivoted Upper Sash, Pivoted Upper and Lower, Top Hinged, Stationary Lower and Top Hinged Upper, Stationary, Single Pivoted, Pivoted Lower.

Chicago, E. A. Rysdon & Co., 527 W. 41st Street. Double Hung, Pivoted Upper Sash.

Chicago, Sykes Steel Roofing Company, 19th Place and Sangamon Street. Double Hung, Pivoted Upper (two types), Pivoted Upper and Lower, Pivoted Lower, Single Pivoted, Stationary, Top Hinged, Twin Pivoted Upper, Twin Top Hinged, Twin Double Hung.

Chicago, Voigtmann & Co., 445–449 W. Erie Street. Pivoted Upper Sash, Pivoted Lower Sash, Pivoted Upper and Lower Sash, Single Pivoted Sash, Three Pivoted, Three Sash, Upper and Lower Stationary, Middle Pivoted, Twin Pivoted, Twin Stationary, Double Hung, Top Hinged Sash, Stationary, Top Hinged Upper and Stationary Lower Sash, Casement.

Cincinnati, Edwards Mfg. Co., Eggleston Avenue, 4th and 5th Streets. Double Hung, Pivoted Upper.

Cincinnati, Jacob Freund Roofing Co., B. & O. S. W. Ry., near Mitchell Avenue. Pivoted Upper Sash, Pivoted Upper and Lower Sash, Single Pivoted Sash.

Cincinnati, Thomas Lee, 128 W. Second Street. Double Hung, Pivoted Upper Sash, Pivoted Upper and Lower Sash, Pivoted Lower, Single Pivoted, Hinged, Stationary.

Cincinnati, Witt & Brown, 215 W. Third Street. Pivoted Upper Sash, Pivoted Upper and Lower, Double Hung, Single Pivoted, Stationary.

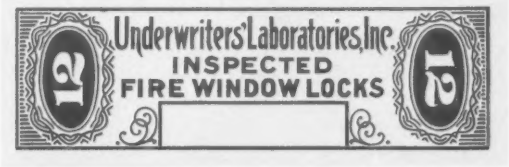
Cleveland, Ohio Roofing Co., 1477 Euclid Avenue. Double Hung.
Cleveland, Riester & Thesmacher Co., 1514–1526 W. 25th Street. Counterbalanced (two types), Pivoted Upper Sash, Double Hung.
Columbus, F. O. Schoedinger, 146–148 N. Third Street. Double Hung.
Detroit, W. J. Burton Co., 164–166 W. Larned Street. Double Hung.
Galveston, A. Fedder & Co., 2624 Mechanics Street. Double Hung.
Hoboken, Leonard Sheet Metal Works, 215–221 Grand Street. Double Hung.
Kansas City, J. A. Ritzler Cornice & Ornament Co. Double Hung, Pivoted.
Kansas City, Henry Weis Cornice Co., 1811–1815 Wyandotte Street. Pivoted Upper Sash (two types), Pivoted Upper and Lower Sash (two types), Single Pivoted Sash (two types), Stationary, Double Hung, Single Top Hinged, Fixed Upper and Pivoted Lower.
Kansas City, Zahner Mfg. Co., 12 West 10th Street. Double Hung, (two types), Pivoted Upper, Pivoted Upper and Lower, Single Pivoted, Hinged, Stationary (two types).
Los Angeles, California Cornice Works, 1610–1614 San Fernando Street. Double Hung.
Louisville, Ky., J. F. Wagner & Sons, 1145–1149 Seventh Street. Double Hung, Pivoted Upper.
Milwaukee, Biersach & Niedermeyer Co., 216–220 Fifth Street. Double Hung, Pivoted Upper Sash, Pivoted Lower, Pivoted Upper and Lower, Single Pivoted, Stationary.
Milwaukee, Consolidated Sheet Metal Works, 661 Hubbard Street. Pivoted Upper, Pivoted Upper and Lower Sash, Fixed Upper and Pivoted Lower Sash, Single Pivoted, Stationary, Double Hung, Top Hinged, Twin Double Hung, Twin Hinged, Twin Pivoted.
Minneapolis, Minn., Selden Roofing & Mfg. Co., 70 Western Avenue. Double Hung.
Minneapolis, Stremel Bros. Roofing and Cornice Co., 1215–1219 Washington Avenue N. Double Hung, Pivoted, Stationary, Pivoted Upper and Lower, Pivoted Upper, Single Pivoted, Pivoted Lower.
New Orleans, American Sheet Metal Works, Carrollton Avenue and Edinburg Street. Double Hung, Pivoted Upper Sash, Pivoted Upper and Lower, Single Pivoted, Stationary.
New Orleans, A. J. Nelson Mfg. Co. Double Hung, Pivoted Upper, Pivoted Upper and Lower, Fixed Upper and Pivoted Lower, Single Pivoted, Stationary, Single Top Hinged.
New Orleans, New Orleans Roofing and Metal Works. Double Hung.
New York, J. F. Blanchard Co., Broadway and 23d Street. Double Hung, Pivoted Upper Sash, Pivoted Upper and Lower, Single Pivoted, Stationary.
New York, The Geo. Hayes Co., 71 Eighth Avenue. Pivoted Upper Sash.
New York, Voigtmann & Co., 427 W. 13th Street. Pivoted Upper Sash, Double Hung (2 types), Pivoted Lower Sash, Pivoted Upper and Lower, Single Pivoted, Top Hinged, Stationary, Three Pivoted, Two Pivoted and Stationary Lower, Stationary Lower and Top Hinged Upper, Counterbalanced.
New York, M. F. Westergren, Inc., 213–221 E. 144th Street. Pivoted Upper Sash, Double Hung, Pivoted Upper and Lower Sash.
Philadelphia, David Lupton's Sons Co., Allegheny Avenue and Tulip Street. Pivoted Upper Sash, Pivoted Lower Sash, Pivoted Upper and Lower Sash, Single Pivoted Sash, Double Hung, Casement, Stationary, Top Hinged Sash Opening in, Top Hinged Sash Opening out, Twin Pivoted, Twin Double Hung.
Philadelphia, The J. S. Thorn Co., 20th and Allegheny Avenue. Double Hung, Pivoted Upper Sash, Casement, Pivoted Upper and Lower, Fixed Upper and Pivoted Lower, Single Pivoted, Stationary, Counterbalanced.
Pittsburg, S. Keighley Metal Ceiling & Mfg. Co. Double Hung, Pivoted, Pivoted Upper and Lower, Single Pivoted, Three Pivoted.
Pittsburg, Rasner & Dinger Co. Double Hung.
Salem, O. W. H. Mullins Co. Double Hung, Pivoted Upper Sash, Pivoted Lower Sash, Pivoted Upper and Lower Sash, Single Pivoted, Stationary, Three Pivoted.
San Antonia, Tex., T. P. Walsh. Double Hung.
San Francisco, Forderer Cornice Works, corner Potrero Avenue and 16th Street. Double Hung, Pivoted Upper Sash.
San Francisco, Rulofson Metal Window Works, 315–319 Monadnock Building. Double Hung.
San Francisco, San Francisco Cornice Co., Bryant between 9th and 10th Streets. Double Hung, Pivoted Upper.
St. Louis, Eagle Metal Works Co., 1510–1512 Clark Avenue. Double Hung.
St. Louis, Hopmann Cornice Co., 2571–2573 Benton Street. Double Hung.
St. Louis, Mesker & Bro., 421–519 S. Sixth Street. Pivoted Upper Sash, Pivoted Upper and Lower Sash, Single Pivoted, Double Hung, Stationary, Casement, Vertically Pivoted.

St. Louis, Powers & Boyd Cornice and Roofing Co., 3614–36 16 LaClede Avenue. Double Hung.
St. Louis, John F. Ruth Cornice Works, 4298 Page Avenue. Double Hung.
St. Louis, Von Der Au & Cluss Mfg. Co., 2404–2408 South Jefferson Avenue. Double Hung.
St. Paul, St. Paul Roofing and Cornice Co. Double Hung.
Toronto, Ont., Douglas Bros., Ltd., 126 Adelaide Street N. Double Hung.

WINDOWS, Hardware.

Sash Locks.

Malleable iron locks examined at factory and passed by Underwriters' Laboratories' Inspectors have attached to each box of **twelve locks,** sealing the box, label reading as follows:



The following manufacturers are equipped to supply these devices:

Chicago, Payson Manufacturing Co., 1319 Jackson Boulevard.
New Haven, Conn., The H. B. Ives Co., 11–17 Artizan Street.

Sash Locks.

Malleable iron locks examined at factory and passed by Underwriters' Laboratories' Inspectors have attached to each box of **three locks,** sealing the box, label reading as follows:

The following manufacturer is equipped to supply these devices:

Philadelphia, Pa., Jas. Peters & Son, 1934–1938 North Front Street.

Sash Chains.

The following sash chains in the sizes indicated have been examined and tested and are approved for use on metallic window frames and sash with wired glass as follows:

Community Guaranteed Sash Chain. Oneida Community Limited, Oneida, New York.

Size No. 80 for sash weighing not more than 90 pounds.
Size No. 100 for sash weighing not more than 120 pounds.
Size No. 130 for sash weighing not more than 160 pounds.
Size No. 250 for sash weighing not more than 210 pounds.

Hot Galvanized Steel Sash Chain, looped type. Bridgeport Chain Co., Bridgeport, Conn.

Size No. 1 for sash weighing not more than 80 pounds.
Size No. 2 for sash weighing not more than 130 pounds.
Size No. 3 for sash weighing not more than 195 pounds.

WIRED GLASS.

It has not been judged necessary to extend label service to this material up to the present time. Distinctive marks applied by the companies themselves to that portion of their product constructed in accordance with the standard (without constant supervision of such marking by the Laboratories) has been considered acceptable.

New York, N. Y. Mississippi Wire Glass Co.

This company claims exclusive right to the use of hexagonal mesh in wired glass Decision of the Court of last resort on this claim is not yet obtained. In the meantime sub-standard wired glass using hexagonal mesh is occasionally found on the market. Members should therefore make careful inspection of this type of product before acceptance.

Philadelphia, Pa. Continuous Glass Press Co.

Marking: Consists of a strand of the wire mesh made by twisting two No. 27 gage wires together, and spacing such distinctive cabled strand approximately 10 inches apart in each sheet of glass manufactured.

Pittsburg, Pa. Arbogast-Brock Glass Co.

Marking: A U-shaped piece of wire, 3-16 of an inch in height, embedded near one corner or spaced about 15 inches apart vertically and horizontally in each light.

Streator, Ill. Western Glass Co.

Marking: Consists of five loops at each vertical strand of wire mesh.

Washington, Pa. Highland Glass Co.

Marking: Consists of a double strand of wire at intervals of 9½ inches. The two wires of the double strand are not twisted together except at the twisted portions of the mesh.

New York, N. Y. Mississippi Wire Glass Co., for American District Telegraph Co., 195 Broadway.

One-fourth inch wired glass with series of parallel wires about ½-inch apart, approximately midway between surfaces. Designed for use in connection with burglar alarm equipments. Submitted as possessing some value as fire retardant.

When mounted in standard window frames with lights not in excess of 720 square inches and with neither dimension in excess of 48 inches, this glass is approximately 50 per cent. as efficient as standard wired glass for protection against moderate exposure.

Drug Houses---Fire Record.

Total Number of Fires, 131.

1. CLASSIFICATION OF CAUSES.

Common Causes.

LIGHTING. Number of fires, 11.

Electric lighting, 2 fires.

Insulation on electric lighting wire was defective and wire grounded on conduit.

Defective wire in long cord on drop light used as a portable light.

Gasolene lighting, 3 fires.

While filling reservoir of gasolene gas generator, escaping gas accumulated around burner, causing an explosion.

Defective gas jet gave air to gasolene gas generator after same had been shut off, causing explosion.

Carelessness of porter with gasolene pressure lighting system.

Candles and matches, 6 fires.

Employee left lighted candle on shelf. Candle burned low and ignited stock of snuff.

Candle or lighted match used by workman after working hours.

Employee dropped match into box of excelsior.

Employee used match for light while drawing turpentine and ignited turpentine on wooden supports of barrel.

Employee using matches to locate stock.

Lighted match thrown down after lighting gas.

HEATING. Number of fires, 1.

Defective flue in wall ignited same.

POWER. Number of fires, 1.

Grounded electric power circuit.

BOILER (or fuel). Number of fires, 4.

Overheated flue in brick chimney ignited stock piled against same.

Heat from boilers ignited woodwork.

Pile of kindlings in front of boiler ignited.

Hot ashes in wooden barrel.

RUBBISH (or sweepings). Number of fires, 6.

Spontaneous combustion of rubbish, 4 fires.

Spontaneous combustion of sweepings which contained chemicals.

Started in a barrel of excelsior packing, etc.

OILY MATERIAL. Number of fires, 4.
Spontaneous combustion of varnish and sawdust in a barrel.
Spontaneous combustion of oily sawdust in a barrel.
Spontaneous combustion of oily rags thrown down by painter.
Spontaneous combustion in a pair of oily overalls.
SMOKING. Number of fires, 1.
Match carelessly thrown among shavings.
LIGHTNING. Number of fires, 1.
LOCOMOTIVE SPARKS. Number of fires, 0
MISCELLANEOUS. Number of fires, 7.
Repairing gas main. Escaping gas exploded and wrecked building.
Telephone wires crossed with high tension wires caused short circuit.
Building collapsed and ignited.
Matches in employee's coat pocket ignited.
Careless use of matches.
Rekindling of previous fire.
Plumber working in building accidentally tipped over his gasolene fire pot.

Special Hazard Causes.

STORAGE OF CHEMICALS AND CHEMICAL FIRES. Number of fires, 14.
Spontaneous combustion in barrel of powdered charcoal.
Explosion in storage closet containing chlorate of potash.
Container of barium dioxide exploded while being opened.
Fire started in a barrel containing some "Nitraniline" which, in powdered form, is susceptible to spontaneous ignition.
Explosion of bottle of nitric acid left on floor near shipping room door.
Explosion of chemicals packed and ready for shipment.
Originated in chemical storeroom from unknown cause.
Spontaneous combustion in storeroom.
Explosion of barrel of tar oil.
Fires of chemical origin, 5.
Spontaneous combustion of condition powders.
Spontaneous combustion in boxes of patent medicine.
Phosphorus thrown into wooden box.
Spontaneous combustion of chemicals.
Unknown in chemicals stored on shelf.
GRINDING AND PULVERIZING. Number of fires, 8.
Spontaneous combustion in herb grinder.
Foreign material in herb grinder.
Foreign substance passing through mead grinding mill caused spark.
Spontaneous combustion of powdered charcoal in enclosure of grinding mill.
Ignition of a black lead compound used for steam pipe packing while being ground. Ingredients of compound unknown.
Phosphorus compound ignited in grinder.
Foreign substance in rosin caused spark in grinder.
Friction in pulverizer ignited contents.

DRY ROOMS OR BOXES. Number of fires, 7.

Paper and rags were allowed to collect on steam pipes in drying box.

Gas stove under pill dryer left burning. Stove became overheated and set fire to dryer.

Spontaneous combustion of chemicals in dry room.

Overheating of dry box or closet, 2 fires.

Unknown in drug dryer.

Unknown in small dry box.

COMPOUNDING. (Including patent medicine and tablet making.) Number of fires, 12.

Flame of Bunsen burner ignited solution of hydrastine white alkaloid.

Gas flame ignited fumes from tincture of opium.

Employee heating camphorated oil over oil stove when same caught fire.

Ignition of fir balsam being heated over gas stove.

Employee making solution with balsam tolu. Alcohol poured into melted balsam before melting pot was sufficiently cool.

Explosion of can containing a tincture of benzoin which was being heated in a kettle of water.

Spontaneous combustion of chlorate of potash, chlorate of iron and licorice powder while being triturated in a porcelain mortar.

Explosion of a small kerosene oil stove used for heating compounds.

Heat from small kettle heating furnace ignited wooden floor.

The punch in a tablet machine became overheated and ignited the chlorate of potash.

Boiling over of a kettle of wax used for coating pills.

Gasolene used in coating process blazed up in copper kettle.

DISTILLING. Number of fires, 1.

Explosion of still containing a solution of acetone.

IGNITION OF VAPORS FROM HAZARDOUS LIQUIDS. Number of fires, 14.

Ignition of vapors from alcohol, 9 fires.

Ignition of can of alcohol by torch.

Carelessness of employee with match or candle ignited wood alcohol.

Ignition of barrel of wood alcohol from lighted taper being held too close while alcohol was being drawn.

Explosion of wood alcohol which was being drawn. Employee used open light.

Faucet knocked out of alcohol barrel. Vapors ignited by watchman's lantern.

Bung flew out of barrel of alcohol, and vapors ignited by a lantern.

Spark from controller of electric elevator ignited alchohol on woodwork which had leaked through from floor above.

Vapors from an alcohol solution ignited by watchman's lantern.

Alcohol explosion, cause unknown.

Employee drawing gasolene from five gallon can with lantern close by.

Benzine vapors ignited from heating stove.

Carbon bisulphide vapors ignited, probably by spark from shoe nails on cement floor.

Employee used open light while pouring varnish from large to small cans.
Employee dropped bottle of anodyne, fumes ignited by gas jet.

MISCELLANEOUS. Number of fires, 1.

Unknown in barrel of scrap celluloid in storehouse.

Summary.

Common Causes.	No. of Fires	Per Cent of Whole
Lighting	11	11.8
Heating	1	1.1
Power	1	1.1
Boiler (or fuel)	4	4.3
Rubbish (or sweepings)	6	6.5
Oily material	4	4.3
Smoking	1	1.1
Lightning	1	1.1
Locomotive sparks	0	.0
Miscellaneous	7	7.5
Total	36	
Special Hazard Causes.		
Storage of chemicals and chemical fires	14	15.1
Grinding and pulverizing	8	8.6
Dryrooms or boxes	7	7.5
Compounding (including patent medicine and tablet making)	12	12.9
Distilling	1	1.1
Ignition of vapors from hazardous liquids	14	15.1
Miscellaneous	1	1.1
Total	57	
Common Causes	36	39
Special Hazard Causes	57	61
Total	93	
Incendiary	2	
Exposure	5	
Cause Unknown Fires	31	
Total Drug House Fires	131	

2. DETAILS OF CAUSES.

Common Causes.

H-2755. Fire occurred in the storeroom containing herbs in bags, empty packages, etc., and was caused by employee using lighted matches to locate stock. Storerooms should be equipped with electric lights where possible so that employees will have no cause to use matches.

H-2935. At the point where the service electric wires entered building, they were protected from the steel beam spanning entrance by flexible tubing. The friction of the tubing against beam and rain caused wires to grind on beam breaking insulation. Short-circuit occurred, burning wires and slightly damaging the building. Current of 500 volts used to run fans in salesroom.

S-7134. Building was lighted by a gasolene gas producer. This was shut off too quickly and one jet, which was defective, gave air to the machine. This caused a slight explosion, the flash opening two sprinklers.

S-8361. The 220 volt supply wires were run in metal conduit. Where wires left conduit, bushing had been omitted. Insulation on wires became defective, and wires short-circuited on conduit. Engineer located trouble immediately and cut current off.

Special Hazard Causes.

S-1. Fire was caused by a draft from an open window which threw the flame from a Bunsen burner into a solution of hydrastine white alkaloid which ignited.

H-455. Fire occurred in steam dry box in compounding room. Paper and rags were allowed to collect on steam coil in bottom of wood dry box. Coil is supplied with live steam. Fire spread rapidly, owing to the dry condition of the woodwork.

H-952. A brick oven or furnace for heating kettle had been erected in contact with, and partially resting on, the wooden floor. The brick work evidently became sufficiently heated to set fire to the floor. The fire in this oven had been put out at close of working hours, but fire was not discovered until it had gained great headway,

S-1202. Stove under small pill dryer was left burning. The dryer became overheated and ignited.

S-1301. Fire originated in laboratory. Employee carelessly threw a small piece of phosphorus into wooden waste barrel and contents ignited.

S-1507. Fire started in a case containing several different kinds of drugs and chemicals packed and ready for shipment. The cause of fire is unknown, but is attributed to chemical origin.

S-1626. Employee was heating a can of fir balsam over a gas stove. Solder melted from bottom of can allowing bottom to drop out, and the balsam was ignited from gas flame.

S-1628. Fire occurred while grinding rosin in a Schurtz O'Neil mill, set up on a frame box seven feet long, four feet wide and two feet high, with a canvas arrangement to allow escape of air. Foreign substance in stock caused spark, igniting contents and fire burned the canvass and small supporting frame.

S-1854. Employee filling keg with wood alcohol from barrel. Barrel of alcohol was located in the basement where it was dark, and employee used a lighted taper for light. Alcohol vapors ignited, but there was no explosion. Employee was unable to close faucet on barrel and burning alcohol ran over floor of basement.

H-2265. Employee filling a small bottle with gasolene from a five gallon can in basement used a lantern for light. A flash occurred, and he dropped the bottle upon the floor, setting fire to goods in basement.

S-2395. Chemist was bottling up benzoin in laboratory on top floor, and had about one gallon in a can in a water bath on a small coal stove when a small explosion or flash occurred, which the chemist states seemed to fill the whole room. Almost immediately six sprinklers in the room opened and entirely extinguished the fire.

H-2647. A colored porter was pouring benzine out of a five-gallon can into a jug. The vapors evidently were ignited by fire in heating stove about 20 feet away, causing a quick flash fire.

H-3850. A fire started in a gas heated dry box. Plant had been in operation all night drying quinine. Dry box was almost entirely consumed. Exact cause cannot accurately be stated, but it was undoubtedly from the overheating of the dry box.

S-4002. Fire occurred in tablet room. A phosphorus compound ignited from unknown cause, while being ground in a grinding machine.

S-6609. Fire occurred in drug grinding machine from unknown cause. A black lead packing for steam valves was being ground in a steel mill, and dropped into a wooden box under same. This packing was for an engineering concern and consisted of a special mixture, ingredients of which are unknown.

S-8214. Fire occurred in a mead grinding mill where dried herbs were being ground, and was probably caused by some foreign substance entering the mill. Mill runs at 2400 revolutions per minute.

3. ROOMS IN WHICH FIRE OCCURRED.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Storage and Non-Manufacturing	24	80	17	32	18	95	59	58
Boiler Room ...	3	10	..	..	1	5	4	4
Grinding and Extracting	..	..	12	23	..	..	12	12
Compounding or Laboratory ..	3	10	16	30	..	..	19	19
Tablet Room ...	..	..	3	6	..	..	3	3
Pill Coating ...	..	..	2	4	..	..	2	2
Dry Rooms or Boxes	..	..	3	6	..	..	3	3
Total with data given	30		53		19		102	
No data	6		4		19		29	
Total	36		57		38		131	

4. DAY OR NIGHT. (Day Fires 6 a. m. to 6 p. m.)

	Common Causes.		Special Hazards.		Unknown. Incendiary, Exposure		Total Fires.	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Day	19	54	40	70	6	18	65	52
Night	16	46	17	30	27	82	60	48
Total with data given	35		57		33		125	
No data	1		0		5		6	
Total	36		57		38		131	

5. PLANT IN OPERATION.

	Common Causes.		Special Hazards.		Unknown. Incendiary, Exposure		Total Fires.	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Plant in operation	10	36	38	69	7	26	55	50
Plant not in operation	18	64	17	31	20	74	55	50
Total with data given	28		55		27		110	
No data	8		2		11		21	
Total	36		57		38		131	

6. HOW DISCOVERED.

	Common Causes.		Special Hazards.		Unknown. Incendiary, Exposure		Total Fires.	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Employee	12	36	34	62	4	12	50	42
Watchman	3	9	12	22	7	22	22	18
Thermostat	1	3	..	..	..	..	1	1
Sprinkler Alarm	11	33	6	11	5	16	22	18
Outsider	6	18	3	5	16	50	25	21
Total with data given	33		55		32		120	
No data	3		2		6		11	
Total	36		57		38		131	

SPRINKLER FIRE RECORD.

7. EFFECT OF SPRINKLERS.

	No. of Fires.	Per Cent. of Whole.
Extinguished or practically extinguished fire	66	83
Held fire in check	10	13
Unsatisfactory	4	5
Total	80	
No Claim	31	39
Small Loss	39	49
Large Loss	10	12
Total	80	

8. DETAILS OF UNSATISFACTORY SPRINKLER FIRES.

842. Indianapolis, Ind. February 2, 1900. Exposure fire from building adjoining. Building in which fire occurred was of brick construction, five stories high and separated from the wholesale drug house by a thin brick party wall. The grocery house exposure burned out completely except a small portion of the front. The fire went through the party wall on the second floor into the drug house, but was held in check at this point by the sprinklers. About this time the parapet top of the party wall came off and a piece of the wall fell out, throwing the fire directly into the attic and burning the roof out edgewise over the sprinklers, letting down some of the sprinkler piping. Fire also ran out into the large metal cornice and traveled along same to the rear section of the liquor department. It was prevented from entering this department by the aid of several sprinklers in the attic. The sprinklers, with the aid of the fire department, confined the fire to the upper stories.

The damage to the building was not heavy but the damage to the stock was very considerable from water.

Summary: Exposure fire.

2376. Baltimore, Md. February 8, 1904. A six-story and basement brick building of joist construction, open finish, hollow iron front. Occupied as a wholesale drug house. Building equipped with automatic sprinklers, old standard pipe sizes with good water supplies consisting of a 8,000 gallon gravity tank and a four-inch connection from six-inch city main, giving a pressure of from 60 to 80 pounds. Building was directly in the path of conflagration and was totally destroyed.

Summary: Conflagration.

3557. Indianapolis, Ind. February 19, 1905. Five-story brick building in conflagration district. Light joist construction, floor openings unprotected. Building was occupied as a wholesale drug house with some compounding. A number of buildings, including this, were destroyed in

a conflagration. The party wall was thin and weak, and apparently offered no obstruction to the fire. Building was equipped with sprinklers but water supplies were weak, being from the water works, normal pressure from 40-50 pounds, but by the time the fire reached this risk, the pressure was probably much less than this. The second supply consisted of a gravity tank. There was also a steamer connection but it is stated that this was not used. Owing to the severity of the exposure and the weak party wall, sprinklers failed to control the fire and loss was total.

Summary: Exposure fire.

6182. Indianapolis, Ind. July 7, 1907. Adjoining building collapsed, and at the same time sprinklered building adjoining collapsed. Building was four stories and basement in height, of brick, ordinary construction and separated from sprinklered building by a twelve-foot alley. Sprinklered building was of same construction. These buildings communicated at the second, third and fourth floors through metal-clad frame enclosed bridges and through tunnel in basement. When unsprinklered building collapsed, on account of its infirm condition and overloading of floors, it dragged down the north section of the sprinklered building which afterwards ignited. It is said that there was no fire previous to the collapse. Fire itself did little damage and was controlled by the fire department. Sprinkler system was put out of service by the collapse of the building.

Summary: Building collapsed.

9. DETAILS OF LARGE LOSS SPRINKLER FIRES. (Where sprinkler control is satisfactory.)

2768. Peoria, Ill. December 16, 1904. Building was four stories and basement in height, of brick, joist construction. Fire occurred on second floor in laboratory and was discovered by watchman. Fire was caused by the explosion of a kerosene oil stove. Building was equipped with Grinnell lever type sprinklers, old standard pipe sizes; dry system, supplied by city water, 90 pounds pressure. Eleven sprinklers opened and practically extinguished fire.

It is stated that fire department used considerable more water than was necessary and heavy water damage ensued. Loss approximately $8,000.

Summary: Excessive water damage from hose streams.

4425. Philadelphia, Pa. December 12, 1905. Fire started in a one-story frame and corrugated iron shed east of building. Shed was not equipped with sprinklers and was used for grinding herbs. Fire was caused by the explosion of some chemical (exact chemical unknown). At the time of the explosion, there were two men employed in this shed, but they did not know how explosion occurred. Alarm sent in by policeman who heard the explosion. Flames shot up the angle walls of the five and six story brick buildings nearby, entering the six-story building on all floors through angle windows. Fire also entered five-story building through windows up to the fourth floor.

The only windows protected on this side of the property were the windows on the east wall of the five-story building. These were protected by tin-clad shutters, but flames entered the windows before these could be closed. Most of the shutters on the six-story building had been ripped off, and the few remaining were badly in need of repairs as the tin on body of same had rusted away and they were of no service in checking the fire.

Building was equipped with Grinnell glass disc sprinklers, modern spacing and arrangement. Wet system supplied by gravity tank giving 12-33 pounds pressure on sprinklers that opened. Seventy-two sprinklers in all opened and the water curtain kept fire from entering building. Loss approximately $15,000.

Summary: Exposure fire.

4974. Quincy, Ill. January 18, 1906. Building was of joist construction, metal clad, and was attacked by exposure from livery stable at rear. Building equipped with Grinnell glass disc sprinklers, old schedule pipe sizes, dry system, supplied by city water giving 25 pounds pressure. Fifty sprinklers opened and held fire in check.

Notwithstanding the large number of sprinklers that opened and the heavy water loss, it was a decided sprinkler success, as they checked the fire at this point and assisted in saving building and adjacent city block. A number of buildings were totally destroyed. Loss $44,000.

Summary: Exposure fire.

5161. Houston, Texas. July 15, 1906. Fire occurred in compounding room, caused by the defective electric wiring in a long drop cord on electric light used as a portable light. Three Grinnell glass disc sprinklers opened and extinguished fire. Sprinklers were on wet system, supplied by pressure tank giving 75 pounds pressure. Sprinklers were allowed to run over an hour and a half on account of no one knowing how to shut off water. This caused a water damage of approximately $10,000.

This again is a forcible illustration of the necessity of employees understanding location of valves controlling sprinkler equipment.

Summary: Water damage due to ignorance of location of gate valve.

8059. Minneapolis, Minn. March 19, 1909. Fire occurred on sixth floor of the six-story brick building occupied as a wholesale drug house. Caused by the explosion of a drum containing barium dioxide which was being opened. The heat opened up 114 sprinklers on the sixth floor and 20 on the fifth floor which practically extinguished the fire but caused heavy water damage, loss being estimated at $50,000.

Sprinklers were of the Grinnell glass disc type, on dry system, supplied by a pressure tank, city water and steamer connection. So many sprinklers opened that water supplies were quickly reduced and fire department used steamer connection, increasing the pressure and aided materially in extinguishing the fire.

Summary: Quick flash fire opened a large number of sprinklers.

8427. **Philadelphia, Pa. April 6, 1909.** Building of open joist construction, four stories high, walls brick, stairs frame enclosed. Fire started on third floor in a small frame-enclosed grinding room. This small room was not equipped with sprinklers. Fire occurred while grinding charcoal and employee failed to discover same promptly. Building was equipped with Grinnell issue "A" sprinklers, old standard spacing and arrangement, wet system. Primary water supply consisted of four-inch city connection with 20 to 30 pounds pressure. Second supply gravity tank. Twenty-seven sprinklers in all opened and were in operation about an hour, the enclosure obstructing water from sprinklers so that it did not reach seat of fire. Sprinklers held fire in check with a loss, principally water damage, of about $12,000.

Summary: Incomplete sprinkler protection.

10. POINTS OF INTEREST FROM FIRE REPORTS.

Alarm Service.

S-3364. Sprinkler alarm valve failed to operate as valve was placed in horizontal position and the circuit closer was not sensitive to the operation of one head.

S-4052. Sprinkler alarm valve operated but bell failed to ring as spring on same was weak. Fire finally discovered by watchman who saw water coming through floor.

S-6652. Sprinkler alarm operated satisfactorily and sent in alarm to the chief of the fire department. Watchman had not started on his rounds and was busy closing shutters and doing other work.

Automatic Sprinklers.

S-1202. Fire occurred in pill dryer due to overheating. One sprinkler opened and confined fire to the inside of the dry box. Firemen, however, used a hose stream in the laboratory and swept bottles and stock from the shelves and deluged the room and the floors below. Sprinkler would have undoubtedly extinguished fire.

Gate Valves.

S-6919. Employee in risk at time of fire did not know how to shut off water. Later another employee came in and shut the valve. Water damage approximately $4,500.

Obstructions to Distribution.

S-4484. Fire occurred in a small closet under a show case from unknown cause. Show case prevented water from sprinkler from extinguishing fire and it was necessary to use fire department chemical.

11. NUMBER OF SPRINKLERS OPENED.

No. of Sprinklers Operating.	Extinguished Fire. No. of Fires.	Extinguished Fire. Per Cent.	Held Fire in Check. No. of Fires.	Held Fire in Check. Per Cent.	Unsatisfactory. No. of Fires.	Total. No. of Fires.	Total. Per Cent.	No. of Sprinklers Operating.	No. of Fires.	Per Cent of Whole.
1	29	44	1	10	..	30	38	1	30	38
2	11	17	3	30	..	14	18	2 or less	44	56
3	5	8	1	10	..	6	8	3 or less	50	63
4	5	8	..	..	..	5	6	4 or less	55	70
5	3	5	1	10	..	4	5	5 or less	59	75
6 to 9 inc.	5	8	..	..	..	5	6	Less than 10	64	81
10 to 24 inc.	6	9	1	10	..	7	9	Less than 25	71	90
25 to 49 inc.	..	..	1	10	..	1	1	Less than 50	72	91
50 and over	2	3	2	20	3	7	9	50 and over	7	9
Total	66		10		3	79				

Average number of sprinklers opened, not including unsatisfactory, 7.6.

12. ALARM SERVICE.

	Satisfactory. No. of Fires.	Satisfactory. Per Cent.	Failure. No. of Fires.	Failure. Per Cent.	Total
Watchman alone	6	100	..	..	6
Sprinkler alarm alone	8	100	..	..	8
Thermostat alone	..	..	..	..	

	Watchman. Satisfactory.	Watchman. Failure.	Sprinkler Alarm. Satisfactory.	Sprinkler Alarm. Failure.	Thermostat. Satisfactory.	Thermostat. Failure.	Total
Watchman and Sprinkler Alarm	4	..	4	..	..	..	4
Watchman, Sprinkler Alarm and Thermostats	1	..	1	..	1	..	1

NOTE. — These tables do not include fires where alarm service does or does not operate properly if fire is at once discovered by employee, the alarm service having no bearing on such fires one way or the other.

13. SECONDARY WATER SUPPLIES.

4057. Primary supply; pressure tank giving 80 pounds pressure. Second supply, city water works and steamer connection. Eighteen sprinklers opened and steamer connection was used by the fire department and assisted in giving a good working pressure.

4327. Primary supply, pressure tank giving 100 pounds pressure. Secondary supply, gravity tank. Sixteen sprinklers opened. The pressure tank was entirely exhausted and about 5,000 gallons drawn from the gravity tank. Sprinklers controlled the fire satisfactorily.

8059. Primary supply, pressure tank giving 75 pounds pressure. Second supply, city water works and steamer connection. One hundred and thirty-seven sprinklers opened and practically extinguished fire. Pressure tank was quickly exhausted and city water works and steamer connection of great value.

14. EFFICIENCY OF WATER SUPPLIES TO SPRINKLER SYSTEMS	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Pressure. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Number Sprinklers Opened. Extinguished fire (or practically extinguished)	Held fire in check
Water works,	32	40	68	5.7	88	6	6	72	28	60	3.4	38.5
Gravity tank,	12	15	21	9.3	67	33		22	20		3.6	20.7
Pressure tank,	32	40	92	9.1	84	13	3	92	90	85	9.6	5.8
Automatic pump,	3	4	58	3.7	100			58			3.7	
Total,	79		70	7.6	84	13	4	73	49	68	6.0	18.3

15. EFFICIENCY OF WATER PRESSURES ON SPRINKLER SYSTEMS.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Pressure. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Number Sprinklers Opened. Extinguished fire (or practically extinguished)	Held fire in check
Less than 15 lbs.,	1	1	10	2.0	100			10			2.0	
15 to 24 inclusive,	8	10	18	15.6	50	50		18	19		4.2	27.0
25 to 49 inclusive,	13	16	34	16.5	77	15	8	34	30	45	14.7	26.0
50 and over,	57	72	87	4.6	90	7	4	87	90	80	4.5	5.7
Total,	79		70	7.6	84	13	4	73	49	68	6.0	18.3

16. EFFICIENCY OF WET OR DRY SPRINKLER SYSTEM.	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	Per Cent. of Fires. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Pressure. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Number Sprinklers Opened. Extinguished fire (or practically extinguished)	Held fire in check
Wet system,	52	66	63	6.0	85	4	11	68	34	60	4.3	18.5
Dry system,	27	34	83	10.7	81	15	4	85	73	85	9.4	18.0
Total,	79		70	7.6	84	13	4	73	49	68	6.0	18.3

Note—"Average number of sprinklers opened" does not in any case include the Unsatisfactory fires.

17. EFFICIENCY OF WATER SUPPLIES TO SPRINKLER SYSTEMS —As Regards Amount of Loss.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Water works,	32	40	68	5.7	41	44	16	70	73	53	1.7	4.4	29.3
Gravity tank,	12	15	21	9.3	42	50	8	18	25	16	5.0	2.3	73.0
Pressure tank,	32	40	92	9.1	34	56	9	91	96	65	7.9	4.4	58.5
Automatic pump,	3	4	58	3.7	67	33		68	40		2.5	6.0	
Total,	79		70	7.6	39	49	11	69	75	53	4.5	4.1	46.3

18. EFFICIENCY OF WATER PRESSURES ON SPRINKLER SYSTEMS —As Regards Amount of Loss.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Less than 15 lbs.,	1	1	10	2.0	100			10			2.0		
15 to 24 inclusive,	8	10	18	15.6	25	50	25	17	18	21	6.0	3.2	100.0
25 to 49 inclusive,	13	16	34	16.5	31	46	23	34	33	37	3.7	3.3	54.6
50 and over,	57	72	87	4.6	42	51	7	82	92	81	4.6	4.4	7.0
Total,	79		70	7.6	39	49	11	69	75	53	4.5	4.1	46.3

19. EFFICIENCY OF WET OR DRY SPRINKLER SYSTEMS —As Regards Amount of Loss.					Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
	Number of fires	Per cent. of fires	Average pressure	Average number sprinklers opened	No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Wet system,	52	66	63	6.0	44	46	10	62	68	48	5.3	3.0	34.3
Dry system,	27	34	83	10.7	30	55	15	88	87	60	2.0	5.9	58.3
Total,	79		70	7.6	39	49	11	69	75	53	4.5	4.1	46.3

Note—"Average number of sprinklers opened" does not in any case include the Unsatisfactory fires.

General Fire Record.

UNSATISFACTORY OR SERIOUS FIRES IN RISKS EQUIPPED WITH SPRINKLERS.

8857. Atlanta, Ga. June 9, 1909. Cotton Mill. Fire was discovered in picker room in the conveyor system. Blazing cotton dropped from condenser onto a pile of loose cotton, spreading over the pile. An employee immediately ran to a small hand hose attached to sprinkler pipes, but on opening the valve no water came. This employee heard the sprinklers opening, but saw no water come from them, and as the fire was spreading rapidly throughout the entire room, he was forced to leave. The fire was then fought with hose streams laid by the mill department and by the city department, the hose lines being carried up the stair tower and also being directed into the burning room from a standpipe on the platform of a storehouse near by.

By hard work the fire was confined to the room in which it originated, although more or less damage was done on the floors above and below by water.

Investigation after the fire showed that the post indicator valve, controlling supply to sprinklers in picker building, was defective, and registered open, although valve was closed. Had the water been on sprinklers at the time fire occurred the result would probably have been an ordinary picker fire. Loss approximately $15,000.

Summary: Water shut off; defective gate valve.

8858. Columbus, Ga. July 20, 1909. Cotton Mill. Fire occurred in dye house, a three-story open joist constructed building containing five cyclone dryers. Fire started in one of the dryers from cause unknown. Dye house equipped with Grinnell glass disc sprinklers, wet system, modern pipe sizes, spacing and arrangement. System supplied by gravity tanks, 20 pounds pressure on sprinklers.

Water supplies came from each end of a long yard main. A valve had been inserted in the yard main at about the center, so that either end could be cut off for repairs, and the pressure would still be on the other end of the system. System was being repaired, and this separating valve was closed, but was found to leak, consequently it was necessary to shut off both supplies, and the entire system was put out of commission in order to drain the system, and repair the leaky joint.

While the repairs were being made fire broke out in the dry room, and there being no water on the sprinklers or the standpipes it gained headway rapidly, and some time elapsed before hose streams were laid from the fire pump, or were brought into service by the city department. The

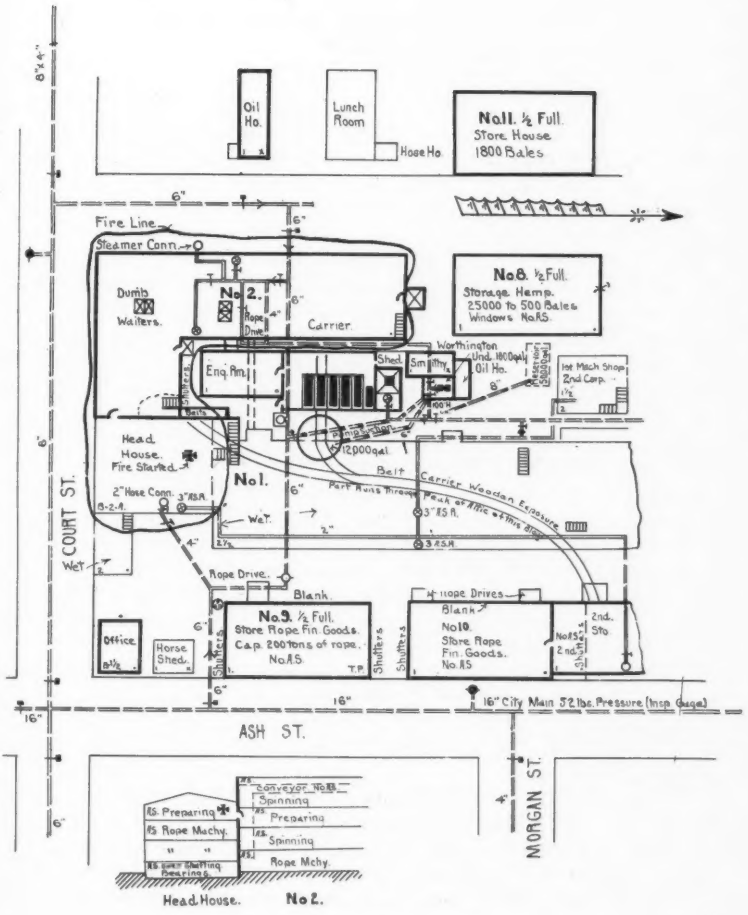
water was also turned into the yard main and into the sprinkler system, but so many sprinklers had opened that with the many hose streams in service little help was obtained from this source.

The fire was confined to the room in which it originated, although the roof was badly burned. Loss approximately $10,000.

Summary: Water shut off, owing to repairs.

8853. New Bedford, Mass. July 23, 1909. Cordage Works. Fire started at 7 A. M. in frame head house building in machine used for tow picker and dusting. Exact cause is not known, but was probably due to foreign substance in the stock. This building was of frame joisted construction, fairly well cut off from No. 2 brick mill adjoining, and not cut off from rope-walk section. When fire was discovered, foreman of the room pushed the electric button which operated the emergency engine stop. This notified engineer of trouble, as did also the sprinkler alarm, which operated immediately. The room was equipped with Grinnell sprinklers of the glass disc type, recently installed to replace metal disc type. Pipe sizes were old, 1-3-6 standard, and the heads were not staggered under joisted construction. Sprinklers were on dry system under about 35 pounds pressure, and there were nearly 600 heads on the system. The water supplies were town water about 50 pounds pressure and 1,000 gallon steam pump, draughting from 62,000 gallon cistern or from town mains. The engineer went at once to fire pump and had it started within two minutes. Private brigade had a stream on the fire within five minutes of its discovery. Public alarm was rung in and department responded promptly, although on account of eight different fires in town since the previous noon, the department was in an exhausted condition. The pump at first draughted from city mains, but at the request of the fire department suction was changed over to the cistern, and this supply was used until it was exhausted.

There was considerable loss to stock lying about the repairing room, possibly about 5,000 pounds. Fire flashed rapidly through the room and drove out the employees and opened the sprinklers in this room. There was possibly 300 feet of pipe between where the fire started and the dry valve, and this together with old pipe sizes caused unusual friction loss in the pipes. The sprinklers with the aid of hose streams held the fire for some time, but finally it was discovered that the fire had worked through the fire wall, and was spreading in No. 2 mill. The fire probably worked through one or more small openings in fire wall, as there were several such openings covered with iron doors which were not absolutely tight. Inside of No. 2 mill there was a wooden belt and bucket conveyor running from second to third floors, tightly boxed, but containing no sprinkler inside. Fire went into this flue, and on account of this and low pressure on system, due to large number of heads already opened in head house building, and to the large amount of loose stock in the room, it spread rapidly, and soon got beyond sprinkler control. As a result, the entire No. 2 mill was wet down, and the upper floors gutted. Fire was prevented from spreading, however, in a northerly direction and did but little damage in No. 1 mill.



Sprinkler Fire No. 8853.

The causes of sprinkler failure may be summed up as follows:—

1. Large dry-pipe system and small pipe sizes.
2. Large amount of loose stock caused quick spread of fire.
3. Defective fire-wall allowed fire to pass unnoticed, and to gain considerable headway in section not thoroughly protected with sprinklers, and where water pressure had been reduced by excessive draughting in both sections. Loss approximately $60,000.

Summary: Defective equipment.

8851. Niagara, Falls, N. Y. August 5, 1909. Paper Mill. Fire occurred on top floor of brick building, joist construction, used for the storage of sulphite pulp and water tanks. Ceiling was of plank and timber construction, with four foot bays; wood columns; 12-inch brick walls; five-inch floor of four-inch plank and one-inch top covering; not arranged to drain.

Fire was discovered by employees in floor below hearing sprinklers open, and they immediately gave alarm. It is not known whether the sprinkler alarm operated or not. Building was equipped with Manufacturers' type "A" sprinklers; 112 in room and all opened. Pipe sizes, 1-2-4; modern spacing and arrangement; obstruction to distribution was not severe. Sprinklers were on wet system supplied by waterworks giving 25 to 30 pounds pressure on sprinklers that opened. There was no secondary supply.

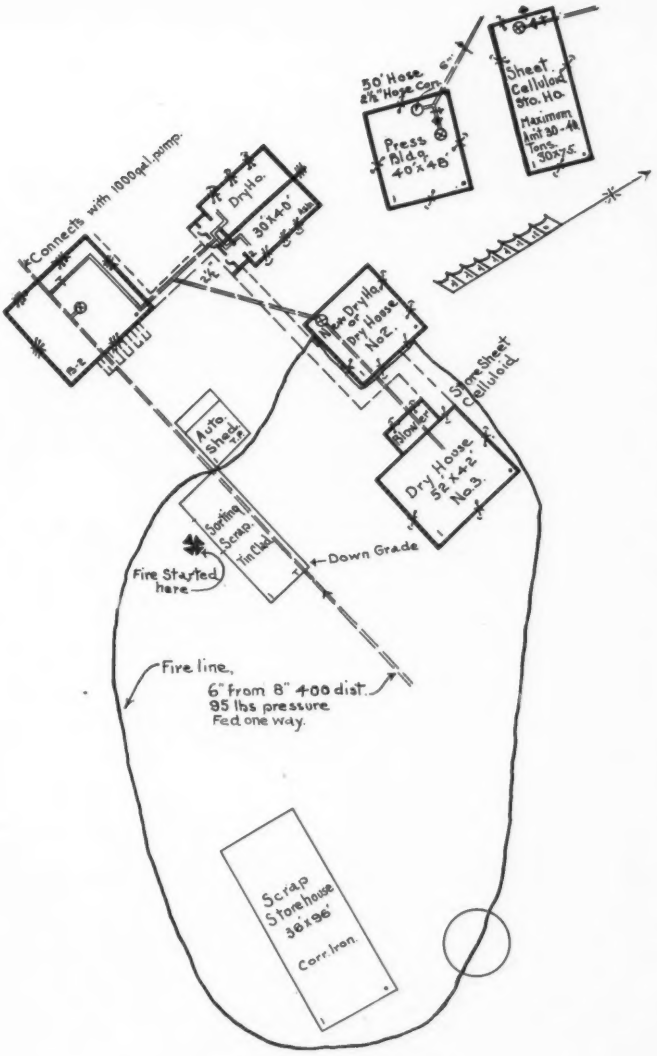
Mill was shut down undergoing repairs, but several men were working in building at the time of fire. They immediately tried to extinguish fire with chemical extinguisher, water pails and yard hose. Fire department responded, and soon had six to eight streams on fire. Fire was extinguished in about an hour. Every sprinkler in room was found open.

Main fire was in center of room, and badly damaged ceiling and burned into floor, although not through. The good construction of the building aided materially in confining the fire to floor on which it started. Most of the damage was from water. About the time fire was extinguished, roof supports became weakened enough to allow roof to sag a little and break a three and one-half-inch sprinkler pipe so that system had to be shut off. By this time fire was nearly out, and was quickly extinguished by firemen.

No reason is given for the failure of the sprinklers to control this fire in its incipiency, nor the cause for the opening of so many heads. It is conjectured that the water was shut off at an early stage of the fire and turned on again later, this allowing the fire to rapidly spread and open a large number of sprinklers while same were out of service. Loss approximately $17,000.

Summary: Not classified.

8854. Leominster, Mass. August 12, 1909. Manufacturing Viscoloid (used as pyroxylin plaster.) Employees were unloading barrels filled with viscoloid scrap from motor truck onto wooden platform of a small storehouse, when the bottom of one of the barrels fell out and small


50' Hose
2½" Hose Cart
Press Bldg. 40'x48'
Sheet Celluloid Sto. Ho.
Maximum Amt 20-40 Tons. 30'x75'
Connects with 1000 gal. pump.
Dry Ho. 30'x40'
New Dry Ho. or Dry House No. 2.
Store Sheet Celluloid
Auto Sheds
Shower
Dry House 52'x42' No. 3.
Sorting Scrap Tin Cleat
Down Grade
Fire Started here
Fire line, 6" from 8" 400 dist. 95 lbs pressure Fed one way.
Scrap Storehouse 30'x96' Corrugated Iron.

Sprinkler Fire No. 8854.

pieces of viscoloid falling through cracks of floor in auto truck, ignited from the hot muffler, quickly igniting the viscoloid on the truck as well as that on the platform and in storehouse. The fire spread so rapidly that the employees barely escaped from the storehouse.

Storehouse was one-story frame, metal clad, occupied for storage and sorting scrap viscoloid. This storehouse was not equipped with sprinklers. The heat from the fire was so intense as to scorch one building and burn another at a distance of from 100 to 125 feet, and the turf was destroyed for a considerable distance about buildings.

From the storehouse the fire spread to new brick dry house (No. 3), through the doors and windows, shutters of which were not closed at the time of the fire. Dry house No. 3 was equipped with sprinklers. From dry house No. 3 fire jumped a distance of 100 feet and attacked and consumed the new metal-clad storehouse (36 by 96 feet), doors on the side of new storehouse being open, as a team was unloading stock here.

Storehouse, at which fire started, and storehouse 36 by 96 feet contained a large amount of scrap stock, and dry house No. 3 contained about 40,000 to 50,000 pounds of sheet stock.

No. 2 dry house, situated westerly from No. 3 dry house, was saved with considerable difficulty. No sprinklers opened here. Fire shutters on this building were open at the start of the fire, but were afterwards closed.

Sheet building, new polishing building, shipping building and a dwelling 125 feet north of dry house No. 3 were slightly scorched on the outside, but heat was not sufficient to open sprinklers. It might be said that sheeting building was more or less protected from the fire by a large tree located east of it.

At one time it was thought that the whole plant was doomed, and this probably would have occurred had there been a strong breeze blowing towards the other buildings comprising this section.

The fire was fought and extinguished by private fire brigade and fire department. A very short time was required to bring mill apparatus into use; the public fire department arrived in about 10 to 15 minutes, this plant being nearly a mile from the centre of the town. The fire was under control in about one hour.

Sprinklers in new dry house No. 3 which was burned were of the Grinnell glass disc type, installed 1909; number in room 66 on three-inch riser, due to slatted floors. All sprinklers opened. Pipes installed in 1909. Pipe sizes branch lines 1905, but overloaded for main supply. Spacing and arrangement of sprinklers standard, except size of supply as noted above. Wet system. Primary water supply water works; pressure on sprinklers about 90 pounds. Other supplies furnishing water for sprinklers during fire, 1,000-gallon steam pump. Sprinklers failed to hold fire in this building in check, as building was attacked from the outside.

Summary: Severe exposure fire.

8850. Wilmington, Del. August 27, 1909. Rubber Hose and Tile Works. Fire occurred at 7.15 A. M., in a detached cement mixing building; brick walls; joist floors, covered with heavy sheet iron. Roof joist,

boards and slag covered. The side walls were blank, end walls had windows, and there was also large lantern skylight.

Plant was in operation, and fire was discovered by employee. It occurred in a rubber cement mixer from unknown cause.

The building was equipped with International sprinklers; 1905 standard pipe sizes. Sprinklers spaced six feet by five feet; no obstruction to distribution; wet system supplied by water works. Sprinklers of no value, as a severe explosion occurred, wrecking the system.

The foreman of the rubber department went into the cement mixing room about 7.15 A. M., in order to see if the mixing machine, which had been started shortly before, was running all right. This machine was run by an induction motor inside of the boiler house. The belt connection was covered by a wooden beltway, which formed an open flue between the two buildings.

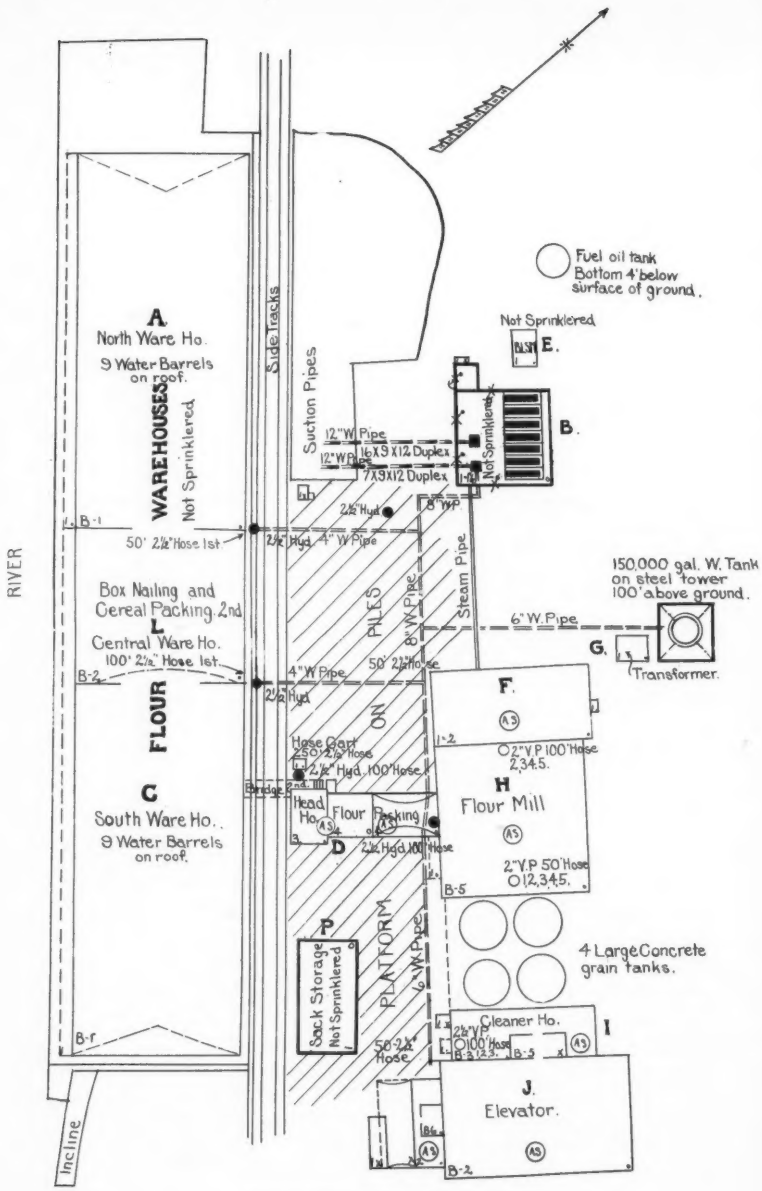
When the foreman went into the cement mixing house he found that the mixing machine had stuck. What part of the machine was at fault, or whether the sticking of the machine had stopped the motor, could not be ascertained.

The main supply of gasolene is stored in iron tank outside mixing house, and pumped into mixing house by a "Bowser" pump located inside of house near the mixing machine. It is claimed that at the time when the machine stuck there was not over one to two gallons of gasolene in the mixer.

What caused it no one knows, but the gasolene in the mixer exploded, wrecking the mixing house, and setting the woodwork near the doors of the boiler house on fire. The fire pump in the boiler room was started immediately, and two lines of hose were manned by the employees, who had the fire well under control before the city fire company arrived, which was called by telephone. The latter attached to city hydrant just outside of the fence surrounding the risk. The firemen claim that the fire kept breaking out every little while, due, probably, to the gasolene that may have been floating on top of the water.

The roof of the building was blown completely off, and the walls blown down with the exception of two to three feet on the sides and ends respectively, and one or two corners, which stood a little higher. The floor was seven-eight inch boards on two inch by three inch joists, and a galvanized iron wearing floor of No. 14 galvanized iron. One half of the iron was rolled back over the other half of the floor by the explosion; the floor boards were torn and splintered. The force, or the greatest force of the explosion, seems to have been up and down, for the roof was entirely destroyed, and about one half of the floor; the walls were blown down, but none of the bricks were thrown any distance. It appeared to be more as if the walls were shaken down than blown down.

There were a man and a boy in the cement house when the explosion occurred. The man was blown out through the roof, and landed on the opposite side of a fence about 20 feet distant, being severely burned and injured. He was the foreman, and probably was at or very near the



Sprinkler Fire No. 8859.

machine when the explosion occurred. The boy was following close behind the man, and he was blown out the door, and injured and burned. The blacksmith stood between his forge and anvil, which are situated just inside the boiler house. He was also injured. His anvil was blown over, while his helper, who stood a few feet away, protected by the wall of the boiler house, was uninjured.

The cement mixing house contained 18 sprinklers. Only nine could be found, and of these nine three were apparently unaffected, the other six being open. The pipes were broken in a good many places, and near where the supply entered the house the pipe was badly bent, although not broken. It was a 2½-inch pipe, and was running full until the fire was put out; then the end was plugged, as this line was taken off the system in the boiler room.

The belt box which protected the belt between the two buildings was burned mainly on the outside near the mixing house. The belt on the inside of the boiler house was uninjured, and there were no signs of fire on the inside of this building.

The one story wood shed adjoining the mixing house was not burned, and the only damage was the turning back of the metal roof for a few feet.

The Bowser pump, which stood near the mixing machine, was blown from its connections and wrecked, so that it will have to be replaced. The piping was broken near the ground, but, being well laid, the gasolene gravitated to the tank, which was undamaged.

Summary: Explosion wrecked sprinkler piping.

8859. Portland, Ore. September 16, 1909. Flour Mills. Fire occurred on the fourth floor of the main flour mill building "H" at 8.40 A. M. Cause is unknown. It is stated that a dust explosion occurred but not of sufficient severity to wreck building. Explosion probably due to spark igniting flour dust.

Flour mill building "H" was a five-story and basement frame building, adjoining and communicating with a one high story (equal to two stories of mill) addition. Floors were plank in basement, single above; all ceilings and timbers were whitewashed throughout. The main building was built on three tiers of 14 by 14 inch timbers, laid horizontally. Open stairs extended from first floor to fifth, together with numerous unprotected vertical floor openings. The one high story frame addition "F" was recently built and was not whitewashed. These buildings exposed elevator and grain cleaner houses "I" and "J" 59 feet south around four large concrete grain bins, which were under construction but practically finished. These bins were empty.

The basement of building "H" contained elevator boots. The first floor contained shafting and pulleys; second floor contained about 103 sets of Stevens and Alis double rolls; third floor contained packers, centrifugal reels, dust collectors; fourth floor contained purifiers, dust collectors, flour bolting chests, sifters, centrifugal reels; fifth floor contained purifiers, centrifugal reels, bolting chests, dust collectors, clippers, differential reels and elevator heads. The engine room was in addition, which is on the same level as first floor of building "H."

Sprinkler Fire No. 8859.

Showing elevator and cleaner buildings at left of concrete grain tanks, main flour mill at the right.

The machinery on each floor was badly congested, and considerable dust had been allowed to accumulate on the woodwork and in the cracks and crevices of each floor.

The elevator and cleaner houses "I" and "J" were two and three story and basement frame buildings with metal and ruberoid roofs, adjoining and communicating with each other. Plank floor basement, single floors above. Ceilings and timbers not whitewashed. Building was built on the ground. The stair openings from first to third stories were enclosed.

Buildings "H," "I" and "J" which were destroyed were equipped with a Grinnell dry pipe automatic sprinkler system with mechanical alarms. Grinnell sprinklers. The primary water supply was an Underwriters' steam pump, rated 750 gallons, also a Stillwell Bierce steam pump with a rated capacity of 500 gallons per minute, giving a pressure of 70 pounds on sprinklers. Both pumps had 12-inch suction from river and discharged into eight-inch, six-inch and four-inch mains, which supplied yard hydrants and standpipe in building, as well as filled the 150,000 gallon sprinkler tank. The standpipe in the buildings were two and one-half inch and three-inch, with two-inch outlets. Hose was linen. The secondary supply to the sprinkler system was a 150,000 gallon water tank on steel tower 100 feet above ground.

The fire starting on the fourth floor where woodwork was heavily coated with dust, traveled so rapidly that the sprinklers did not open in time to check it. This was probably in the nature of a dust explosion. The mill building, together with the cleaner house and elevator house, which had a capacity of about 160,000 bushels, were a total loss. The capacity of the mill was about 4,200 barrels in 24 hours.

It is claimed that the sprinkler system worked all right. Upon inspection of valve house after fire, all valves were found in good condition, and had evidently tripped satisfactorily. However, there is a question as to whether or no the explosion crippled the sprinkler system. It is stated that had there been any immediate outside assistance from the fire department or fire boat, the fire could have been controlled on the fourth floor; however, the plant is located on the river front, with the nearest public fire department engine company three or four miles distant, and about a half-hour run for the fire boat. Engine No. 8 responded to the call at this plant, together with the fire boat, and assisted materially in controlling the fire and keeping it out of the large grain docks, which were built upon piles along the river front; also the sack storage building, the flour packing house, the engine and motor rooms and boiler rooms.

The loss to the buildings is estimated at about $300,000.

The concrete grain tanks, although heavily exposed, were not materially injured, as will be noted from cut. No serious cracks have been detected and there was only a slight spalling on the outside from the intense heat.

Summary: Dust explosion.

Sprinkler Fire No. 8859.

Showing effect of fire on concrete grain storage tanks.

LARGE LOSS SPRINKLER FIRES.

Where Sprinkler Control is Satisfactory.

8852. Pittsburg, Pa. August 3, 1909. Hay Barn and Stock Yards. Building occupied as a hay barn; constructed of brick walls 12 inches thick; pilastered four inches and supporting joisted roof with timber posts; plank floor five feet above earth.

Fire was discovered by employee on bridge leaving plant, who pulled public fire alarm box at 5:55 P. M., the auxiliary alarm box being pulled a little later. Sprinkler alarm was then in operation. The watch service was changing shifts, so that watchman was not on duty at time of fire. Cause of fire is unknown, but probably of spontaneous origin.

Building was filled with baled hay, said to have been perfectly dry and well seasoned before stocking. It was packed solidly in barn from floor to within two feet of sprinklers; about 20 feet high and without aisles. Barn was sealed and had not been broken open for about two months. It is thought that hay became wet through leaks around sash and roof monitors. Fire apparently deep seated but spread to top when sprinklers opened. Sprinklers were of the Grinnell glass disc type, installed in 1903. Pipe sizes and spacing modern. Sprinklers on dry system supplied by water works giving 72 to 75 pounds pressure. Second supply consisted of steam pumps which were of service in extinguishing the fire. Fire was of long duration and was finally extinguished by sprinklers and fire department. Sprinklers were unable to reach seat of fire, owing to its starting deep in the hay, but held fire down and kept it from spreading to adjoining buildings. Contents practically a total loss, building slightly injured. Loss, $7,000.

Summary: Obstruction to distribution.

OTHER SPRINKLER FIRES OF ESPECIAL INTEREST.

8833. Northfield, N. H. June 25, 1909. Woolen Mill. Building in which fire occurred occupied for the drying of carbonized rags. Two story, walls frame, part brick filled and open, roof open joist construction. Fire occurred at 5.30 P. M., and was discovered by employee. Building equipped with Esty sprinklers. Modern spacing and arrangement, standard pipe sizes, being 1-2-3; wet system, supplied by water works, 80 pounds pressure. Seventeen sprinklers opened and held fire in check.

Fire started near the apron of a Sargent dryer in which rags are baked after being treated with acid. Workmen think it started inside the dryer, but the fact that no stock inside was burned or sprinklers opened would tend to show that such was not the case. Cause cannot be ascertained.

Foreman states it is the custom to shut down the dryers each night at five o'clock, thus giving them one hour in which to cool off before workman leaves the building. On the afternoon of the fire, dryer had been shut down for about one-half hour, and the employee who runs it was sitting in the doorway leading to dryer room when he saw the flames flash about the ceiling over the apron of dryer, and at once blew the mill whistle for general alarm.

Sprinklers extinguished fire excepting at one place in ceiling near middle of room, not far from where there was located a 360 degree sprinkler head which did not operate. Had this one head operated and wet down this space, as no doubt it would have had it been a 212 degree head, the loss would probably have been much less. Other sprinklers could not reach it, and when once opened, they probably sprayed more or less water on the hard sprinkler head as they were running on three sides of it.

The seventeen sprinklers were running about an hour, during which time the room was so full of smoke firemen could not enter. Finally the smoke subsided somewhat, and firemen went in with one stream and extinguished what fire remained.

The sprinklers did excellent work in holding the fire as they did, and had the one sprinkler head rated 212 degrees instead of 360 degrees, as it should have been, there is no doubt sprinklers would have entirely extinguished fire with considerable less loss.

About eight of the heads that opened were 212 degrees and slightly corroded, although they apparently operated promptly. There was considerable fine dust about the room, which probably accounts for so many sprinkler heads opening. No stock was burned, and with the exception of the building being charred in one spot, loss was entirely from water. Loss given at $140.

8849. Pittsburg, Pa. August 17, 1909. Mattress Factory. Fire started in the one-story frame storage and shipping building. This building is not sprinklered, and portion in which fire started was occupied for storage of excelsior in bales, iron wire, etc. The day previous to fire four bales of woolen shoddy had been shipped in, and were stored here. The excelsior was piled to within three to five feet of roof, with an aisle in the center. It was along this aisle, in the excelsior and shoddy, that the fire was first seen, and where it evidently started. Cause is unknown.

The fire was discovered at 8.45 P. M. by a clerk. At 8.30, fifteen minutes before, the watchman passed through this building, and noticed nothing wrong. The alarm was sent in immediately, and several chemical extinguishers emptied into flames.

This frame building partially surrounds a two story, basement and attic, brick, unsprinklered building, formerly two dwelling houses, but occupied by factory for storage of bedding and supplies.

The fire burned around this two-story brick building, burning the roof of frame shed almost entirely off.

There also is a one-story brick machine shop, sprinklered, which adjoins one-story frame building and also the two-story brick building, communicating freely with former, but cut off from latter by metal-clad fire doors. Three sprinklers in machine shop opened, and were successful in keeping fire from same. Fire got into attic of two-story building and burned large holes in roof.

A large quantity of goods in the lower floors of two-story building were damaged by smoke and water. The belts and pulleys in machine shop were damaged by water. Practically the whole contents of frame shed were destroyed. No fire damage in main building. The sprinklers in the machine shop were on the 3-inch branch line from a 6-inch riser, and were installed in 1896; 1905 standard pipe sizes and spacing. Grinnell glass disc heads; wet system, supplied by waterworks, 60 pounds.

Sprinklers in machine shop were in operation for about one and one half hours, successfully holding fire in check at this point.

This is another striking example of automatic sprinklers with good water supply stopping an internal exposure fire, and also emphasizes the importance of equipping all portions of entire risk with sprinklers. Loss approximately $17,000.

8856. Bayonne, N. J. September 22, 1909. Barrel Factory. At 10 P. M. a 350,000 gallon gasolene tank, containing about 100,000 gallons of gasolene, suddenly exploded from unknown cause, sending top of tank and burning oil into the air. A heavy wind was blowing, and buildings 200 feet away were ignited. These buildings were not equipped with sprinklers, with the exception of barrel factory. Flames also ignited staves and barrel heads stored in yard.

Engine house whistle was sounded at once and private brigade responded. About 25 lines of hose were laid from hydrant system on circulating mains. These hydrants and the sprinkler equipment in barrel factory are supplied from a pumping station of 16,000,000 gallons capacity every 24 hours at a pressure of from 65 to 75 pounds.

All the surrounding buildings, with the exception of frame barrel factory, were of brick construction, and occupied as storehouses, machine shops, etc. These were burned to the ground, as well as staves and barrel heads piled in yard.

As soon as flames attacked end of barrel factory sprinklers operated and kept fire out of building. The end wall was burned out, but a pile of barrel heads just inside of this wall was only slightly scorched, while the pile outside was entirely consumed. Employees stationed on roof extinguished burning embers and prevented fire from getting a foothold.

Barrel factory was equipped with International sprinklers, 11 of which opened. These were on dry system, primary water supply from steam pumps. Pressure on sprinklers that opened, 20 pounds. Modern spacing and arrangement of sprinklers, 1905 pipe sizes, being 1, 2, 3.

This is an excellent example of automatic sprinklers holding a severe exposure fire in check. The sprinklers kept fire out of barrel factory, and although the end of building and end of roof burned off, the stock was not ignited. Loss approximately $200,000 on unsprinklered buildings and contents, but not over $175 on the frame sprinkler building.

MISCELLANEOUS FIRES.

H-4239. North Woburn, Mass. July 17, 1909. Manufacturing Sodium Nitrite and Litharge. Fire occurred at 3.10 P.M., in building occupied for the manufacture of acetic acid and nitrite of soda. Building was three stories high in part, of open joist construction. Fire started in the one-story section at rotary dryer for sodium nitrite.

Sodium nitrite is dried in a wooden rotary cylinder, 30 feet long, six feet diameter, with open ends. Staves held by three iron annular rings, one at each end and one around the center, having gear teeth by which rotary was revolved with a shaft and pinion underneath. There was a steam coil with steam at five pounds pressure at one end and fan, the hot air being blown through, drying a small quantity of sodium nitrite crystals at one time. Fire started underneath around the greasy gear drive.

Fire is distinctly a special hazard fire, but apparently its origin had no connection with the material being made, but the nature of this material, sodium nitrite, was the cause of the severity of the results.

Sodium nitrate is roasted with metallic lead, forming sodium nitrite and litharge (yellow oxide of lead). The nitrite is soluble and is leached out. The by-product, litharge, is dried. The nitrite is boiled down and crystallized. The crystals are dried as previously mentioned. Sodium nitrite gives off oxygen readily and explosive detonations occur at high temperatures, 750 degrees to 930 degrees C.

Five men were in room where dryer is located when fire was discovered underneath. A stream was immediately taken from a 2½-inch hose connection in building and fire was soon apparently nearly extinguished, when a violent explosion occurred. Man, who was on rotary directing the stream, found himself out in the yard immediately thereafter and was unable to state how he came there, except that it was with exceeding celerity, Fire then spread throughout building and both private and two public fire alarms were sounded. At the extreme west end of building there were from 140 to 150 sugar barrels full of sodium nitrite. These soon began to explode, and a series of explosions continued until it was consumed and fire out. Debris, boards and timber were flying about the yard in a general constant melee and a piece landed on roof of southerly plant about 115 feet away.

Fire pump was started and private brigade used three good streams, making a stand at west end of acetate of soda room, while public department fought at the other end. Fire was well handled, quickly extinguished and a further large loss averted by keeping it out of the tarry sodium acetate.

The fire evidently started from friction around the driving gear, and heat became sufficient to explode contents of rotary. Loss approximately $23,000.

H-4142. Akron, Ohio. August 12, 1909. Rubber Works. Plant is separated into eight good fire divisions and fire was confined to one of these divisions. In general plant was of good brick construction, newer buildings having steel frames, all having slate roofs on wood sheathing. The office and milling room department, where fire occurred, is the center section. It is a one-story building, with part basement and attic, ordinary brick construction, single floors, open joist ceilings, 12-inch walls reinforced by pilasters and connected to other buildings by covered and open passage ways. The door openings were protected by fair fire doors. Area of section was 40 by 185 feet. There was a brick division wall 45 feet from the east end and rising to roof only, separating the office section from the milling room. There were two stairways, one at east end of mill room at division wall, between office section and milling room, from first floor to attic; also one at west end near elevator from basement to attic, both trapped. Elevators, one open.

Basement contained supports for machinery, steam coils, storage of crude rubber and steam traps. First floor contained office and mill room. On this floor were washers, dryers, calenders, grinders, presses, tube machines and compounds. The attic over office was used for storage of fabric and ground "springs," which is a term used to designate scrap and shoddy rubber after it is ground up. This material was in sacks and barrels

Miscellaneous Fire No. H-4142.

and very much resembles muck. Attic over mill room was what is known as the dry room and contained large quantities of crude rubber after it had been milled.

Premises were under full protection of a municipal fire department. Nearest engine house about half a mile distant on paved streets. The nearest city hydrant was about 300 feet distant on a six-inch circulating main; only two hydrants within reach. There was also a steamer stand at river near plant. Inside fire protection consisted of a two-inch standpipe with 50 feet of two-inch hose in basement, on first floor and in attic. Standpipe fed by pumps and also by 10,000 gallon gravity tank. Water for system taken from adjacent river through an 18-inch sewer pipe by gravity to a receiving well located across street from property. Pumps took water from this well and were all cross-connected and arranged to feed both tank and standpipe system as well as furnish water for factory purposes.

The section where fire originated, namely attic, was used for the storage of ground springs and fabric, and occasionally a few men would change their overalls here.

At the time of the fire a night force of about fifteen men were at work throughout the plant. It is not definitely known what started the

fire, but ground springs, if damp, are liable to spontaneous combustion. It is thought that the watchman did not visit this particular section and that fire was smoldering sometime before being discovered at 4.00 A. M.

The A. D. T. records show that watchman started on his four o'clock round at box 121, located in the boiler room, ringing in this box at 4.05; box 122, located in the center of the attic, was rung in about 4.06; box 123, located in basement, was rung in at 4.07; box 124, located in the office, was rung in at 4.08. The watchman then smelled fire and left the office, went up the stairway at the division wall between the office and mill room, opened the fire door leading into the attic over the office, and discovered the entire attic ablaze. He then claims to have shut the door and run down stairs to inform the other men at work. The night engineer turned in the alarm over the A. D. T. system, same being received at central A. D. T. office at 4.10. Alarm was then transmitted to central station by private telephone. Upon receipt of the alarm, operator rang in box 137, which is the private box of a large factory nearby, but informed the nearest engine company by telephone as to location of fire. The reason box 137 was sounded was that it would call out three companies, while box nearest the plant would only have called out one company. Fire departments No. 1, 2, and No. 5 responded promptly. Upon arrival of the chief a general alarm was sounded at 4.37, which brought three additional companies. Company No. 2, being nearest and first to arrive, attached to hydrant nearest plant, using steamer and securing two streams. Captain of company No. 2 claims that his company responded promptly and went up stairs to where the fire was, but that it had already spread into the portion of the attic where crude rubber was drying. Upon arrival of the other engine companies, steamers attempted to take water from river, but bank was too steep and steamers could not get near enough to the water to use the steamer suction. Steamers were then placed at the receiving well and ample water secured. Eight lines were used and in a comparatively short time the roof fell in and fire was under control, in fact the fire was stopped about 40 feet from the west end of building. The large quantities of crude rubber, being in sheets, burned rapidly and fiercely, generating an excessive heat and smoke.

The attic, where fire occurred, is low and not accessible, except by stairways, there being no windows, and firemen had to cut holes in the roof to get at fire properly. There were several metal ventilators in the roof and evidently the fire spread very rapidly along the wood sheathing, aided by the draft of the ventilators. Fire was under control in about one hour after it started, and damage is largely confined to stock of crude rubber, the building and machinery suffering but little damage. Loss estimated to be about $100,000. No loss to adjoining sections.

On Sunday, August 15, another fire occurred at this plant at 1.53 A. M. Watchman discovered fire in extreme south end of frame sheds, south of plant. There is an A. D. T. box at window in carpenter shop, adjoining the shed, and the box was recorded by watchman at 1.50. Three minutes after, the entire shed was ablaze. Alarm was turned in from A.

D. T. box and No. 2 engine company promptly responded. Upon arrival a general alarm was sounded, but was not needed, as fire was soon under control. The windows in the south wall of the carpenter shop were not protected, and fire communicated into same, doing some damage. Entire loss from second fire will not exceed $2,000.

The opinion is now that both of the fires were of an incendiary origin. It would not seem probable that second fire started from spark from railroad, as it was damp and rainy. The rapidity with which the fire spread would indicate the use of inflammable oils.

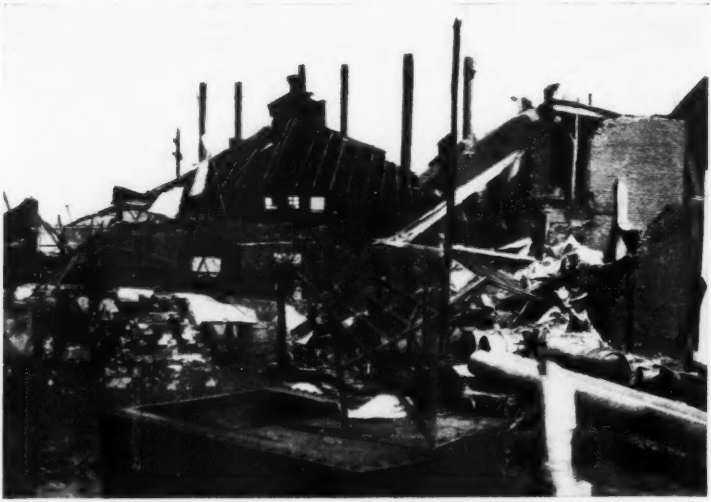
The shed contained crude rubber in barrels and some scrap, also lumber. The company had removed the crude rubber, ground springs and fabric, which had partially been burned at the fire of the 12th, into the yard near the sheds, but not into the shed where fire started.

Three watchmen were on duty at the time of second fire, and all claim that fire was of an exceedingly quick origin and spread very rapidly.

H-4035. Buffalo, N. Y. August 12, 1909. Packing House. Fire started at 11.18 A. M. in cold storage buildings, center of plant. Building in which it occurred is under builders' risk undergoing repairs. Several months ago workmen started to make this section of plant fire-resistive, and considerable work had been done. Floors were being made of concrete on expanded metal, and protected steel beams and columns were being insulated by a cork and asphaltum compound furnished pressed into blocks two inches thick and about 12 inches by 36 inches. These blocks are nailed to two-inch by four-inch studding against brick walls, or forming partitions in rooms, and then the exposed side covered by thin layer of cement.

Fire occurred on fourth floor of five story building; floor of room was of concrete, but ceiling and floor above was only partly changed; same being the old joists and boards. Men were at work on walls of room nailing the insulation above mentioned when fire started. Men disclaim any knowledge of how it started, but it is likely that one of the two had been smoking. As the cork insulation here had not been covered with the cement facing, it caught and burned. Fire practically confined to two rooms, and as rooms were vacant, it fed entirely on the cork and asphaltum mixture and the wood studding, also the partial old floor of fifth story. Fire did not spread rapidly, but dense smoke made it hard to locate. Concrete floor prevented fire from spreading downward, and brick walls and completed fire-resistive sections kept it from spreading to any extent in other directions. Men turned in alarm from numerous auxiliary boxes in plant and from street boxes, and fire department responded promptly. Three alarms turned in, and 18 engines responded in all. Meanwhile organized private fire brigade got into action very quickly, and is said to have had six streams on fire before city department arrived.

Building equipped with 12 to 14 roof hydrants and inside standpipes supplied by pumps, and these were utilized with good effect. The large portable chemical extinguishers on trucks could not be used, as nearby floors were not complete. On the whole, the fire was apparently well handled. Building damage probably $10,000 or less at rough estimate,



Miscellaneous Fire No. H-4121.

*Shows where head of compression tank was found after explosion.

but there may be a heavy water damage and some smoke damage, although as fire was on top of building the smoke was mainly carried off. Thousands of gallons of water soaked through lower floors which were occupied, and it is impossible to estimate the damage at present. Stock in pickle in lower floors and cellar and some piled open on trucks may have been spoiled by water. A better grade of cork compound will be used in remainder of work, and all the old on hand will be discarded.

H-4121. Philadelphia, Pa. August 18, 1909. Oil Gas Plant. Plant manufactures oil gas for railway car lighting and has been in the same location for many years. The buildings, comprising one-story and sheds, skirt the railway tracks for about 100 feet and front on highway about 70 feet.

The gas is made by the "Pintsch" process, petroleum oil subjected to high temperature, which converts the oil into a light vapor or gas, and, after going through a purifying treatment, is pumped into compression holders to a pressure of 75 pounds or more. By this pressure the gas is carried in underground pipes to the railway terminal, at which point the car tanks are filled. The raw stock is called "Pennsylvania Oil," supplied by the Atlantic Refining Company. The oil storage tanks on the premises, which are underground, are of 4,000 gallon capacity and are filled from tank cars. The other apparatus comprises retorts, purifying cylinders, four compression tanks (above ground), the latter measuring 19 feet in length, and four by two feet in diameter (set horizontally), each containing 166 cubic feet of gas. There is also a large gasometer, 37 feet in diameter,

with a capacity of 10,000 cubic feet, about 30 feet from the buildings. A former duplicate to the latter had been dispensed with and removed previous to the fire, and the remaining one escaped the fire through the efforts of the firemen.

The tar deposit is collected, put into iron drums, and disposed of.

At the time of the fire, several of the operatives were present, but their different opinions do not indicate the real cause of the explosion. Some of the men thought that a leakage of gas occurred from the compression pump, but the sudden explosion and immense flame from the burning gas that enveloped the premises and the men before they could get away, indicated that the outlet of the escape was much larger than would come from a pump. Upon examination of the ruins, a head of one of the compression tanks was found some distance from its original position; the head showed that it had been ripped off close to the end, and the other section of the tank had been forced through the wall of the engine room on the highway. The detached head was checked in its course by striking against and breaking some iron drums containing tar, scattering the latter around, which added to the fire. The connections to the other compression tanks were broken, allowing the gas to escape, forming a great volume of flame for a time.

Adjoining the gas plant was an open shed beside the railway track, used by the company for the storage of barrels of lubricating oils, cotton waste and other such supplies. The barrels were fired and the oil gave off dense volumes of smoke, which obstructed access of the firemen. The entire plant, with the exception of the large gas holder and the underground oil storage, was destroyed.

Several previous fires have occurred on the premises but were not attended with such destruction as this one.

The compression tanks are constructed of three-eighths inch iron and are set horizontally in battery form. It was learned that complaint was being made of the low pressure delivered at the terminal, and the force of the explosion and condition of the ruptured compression tank indicated that the tank was ruptured by over pressure, the rupture starting possibly from a weak spot in the iron.

One especial hazard of this gas is the danger of its escape and distribution around before ignition. Coal gas ascends rapidly, but oil gas, being much heavier than the atmosphere, falls and rolls along the ground and is so dense that it can be observed like a cloud. If it becomes ignited in this form it produces an immense flame, lasting longer than a volume of coal gas. This effect was illustrated a few years ago on the occurrence of a rupture of a gasometer containing oil gas on the premises of the United Gas Improvement Company at Point Breeze. In the latter case, the gas rolled along the ground to a distance of over 400 feet, and in its passage entered a building where fire was being used, and becoming ignited at this point, the entire volume of gas took fire extending back to the source of escape. Some of the gas having also entered one of the buildings of the gas company situated near the gasometer, an explosion resulted, blowing out all of the windows and doing other damage.

Miscellaneous Fire No. H-4121.
Showing head of compression tank destroyed by explosion.

A similar danger always existed with this plant, but in the accident now reported the gas was fortunately ignited before becoming distributed much beyond the premises.

It is not known how the gas became ignited, but possibly it was from the retort. Beside the employees, a number of pedestrians were injured, and the glass in the windows in the entire block and in houses nearby was shattered by the effect of the explosion.

A plant of this nature is exceedingly hazardous and should be isolated, as the inherent danger of explosion is always present.

H-3809. Rochester, N. Y. August 24, 1909. Celluloid Novelty Factory. The unsprinklered frame celluloid storage and "dope" mixing building, south of main plant, burned shortly before three P. M., while plant was in operation. No damage was done to main plant, as it was protected against this exposure by a blank wall and open sprinklers.

No inside sprinklers operated. Open sprinklers on west side of main building were turned on and operated satisfactorily.

The building in which fire started was about 25 feet by 30 feet in size, two stories and low basement, of ordinary frame joist construction. Basement was occupied for storage of celluloid scrap. First floor contained a small steam-heated dry room for washed scrap and room for washing and separating paper from scrap, and dissolving celluloid scrap in alcohol and amyl acetate to form nitro-cellulose for coating paper signs, etc. Second floor was used mainly for storage of celluloid in sheets.

Employees in building at the time of the fire first saw the flames coming through the partition in the dry room, indicating that the fire started in dry room or in the basement under the dry room where the celluloid scrap was stored. The cause of the fire is not known. Combustible material in contact with steam coil in dry room is the probable cause.

The fire spread so rapidly that a girl who happened to be on the second floor at the time was obliged to escape through a window. The entire building was in flames in a few seconds, but while the combustion was very rapid and the fire extremely hot, there were no clearly defined explosions, as far as could be ascertained. While there was only a slight wind from the west, the paint on a one-story frame building 70 to 80 feet distant was burned off by the heat.

The alarm was sent in by telephone and from a street box about one block distant. The fire department were a little slow in responding, as the alarm did not come in correctly, the fire burning off the alarm telegraph wires, which passed immediately in front of the burning building, while the box was striking. On their arrival, the department put several streams on the fire and it was controlled almost immediately.

On the first floor there were several open barrels and cans of the nitro-cellulose compound, which has about the consistency of thick molasses; also an ordinary 60-gallon metal oil tank (such as is used for oil in engine rooms) of amyl acetate and several open cans of celluloid scrap. The barrels containing the "dope" were badly burned and the metal receptacle showed evidence of great heat. The "dope" and celluloid scrap showed that they had been burning, but were extinguished with large quantities left in the various receptacles. The amyl acetate in the oil tank, or at least the greater part of it, remained after the fire.

A point of interest brought out in this fire is the indication that while celluloid, and the solution of celluloid in amyl acetate and alcohol, commonly known as "dope," burn very rapidly and make an extremely hot fire, they can be extinguished with water.

H-4088. New York, N. Y. September 1, 1909. Electric Car Barn. Risk was a one-story brick car shed, 100 feet by 300 feet, with tar and gravel roof on one-inch boards on joists on unprotected steel trusses and columns. Floor was plank, and boards laid directly on joists in earth, or with small inaccessible space between floor and earth. A small paint shop and carpenter shop were located in the southeast corner of the barn, and were separated from the remainder of the risk by light frame partition. The rotary sub-station on the west was separated from the barn by a blank wall, but the side walls of the sub-station, rising above the barn several feet, were pierced by window openings with plain glass windows. These windows offered a considerable exposure to the roof of the car barn.

The 550 volt feeders from the sub-station were brought in ducts through the party wall and carried across the barn on the under side of the roof truss to the street.

The building was formerly occupied as a repair shop, but of late has been used mainly as a storage shed for out of season cars, with light repair

work and a small amount of carpentering and painting in the shop sections. Barn was not regularly occupied by any employees during the night, but was covered hourly by watchman with watch clock having four stations. There were three auxiliary fire alarm boxes in the premises, all connected to department alarm box located on the opposite side of street from one end of the barn. There were nine tracks in the barn, with only one track to street, access to all other tracks being dependent upon a transfer table about 80 feet from the front of the barn. No cars were regularly operated from the barn, and it is claimed that of the cars in the barn none had been operated for some days. Trolley switch is said to have been kept open except when cars were to be moved.

On the night of the fire orders were issued for running closed cars, and a car cleaner was sent to the barn to get these cars ready for service. Six double truck box cars had been removed from the barn, and the car cleaner was working on a car just south of the transfer table at about 10.30 P. M., when he smelt smoke, and on investigating found the rear car on track No. 5 in south end of barn on fire, near watch box station, which watchman had punched at 10.15 P. M. Cause of fire is unknown. Car cleaner states that flames seemed to be coming from under car floor, and ran up rear end of car platform. He has been in the employ of the company but a short time, and was not familiar with the auxiliary fire alarm boxes, so ran to adjoining car barn and notified the night foreman. Alarm was immediately given, the fire department responding at once. Second alarm was turned in immediately, followed closely by a third and fourth alarm.

Contents of the barn were practically a total loss, amounting to approximately $155,000.

When the first engine company arrived the fire had not spread through the entire barn, but was in the south end. The wind was blowing from the northwest at a velocity of 24 miles per hour, but was not strong enough, nor from the right direction, to hold fire in check, and the flames spread rapidly through the entire barn. The bare steel roof trusses and columns soon buckled under the intense heat, and the roof fell shortly after 11 P. M., carrying with it part of the side walls, leaving wall standing to lower chord of roof trusses on west side and leaving east wall about seven feet high. The fire threatened to enter the sub-station through the unprotected window openings, but this risk was saved by playing fire streams on the walls. The feeders passing through the barn were of course destroyed, cutting off all power on the systems. Fire burned until 10 A. M. the following morning.

CAUSES OF FIRES.

Special Hazard Causes.

H-4010. Foundry. Fire was started by sparks blowing from cupola onto roof of detached storehouse. Roof shingles were very dry and poor.

Roofs near foundry should be of metal, slag or other fire-retarding coverings.

H-4012. Automobile Garage. Employee was filling gasolene tank of automobile with a five gallon open top can through strainer when the gasolene became ignited from unknown cause. Manager and employee can give only two causes, viz., employee either stepped on a snap match or there were lighted automobile lamps nearby on the same floor.

Recommendations are suggested as follows:—

(1) Permit no open flame, light or heat, or any machine causing sparks in same premises where gasolene filling or handling is done.

(2) Install approved portable gasolene supply tank with direct hose connection into tank of automobile.

(3) Strictly maintain one approved chemical extinguisher to each 1,000 feet of floor area and two pails of sand to each extinguisher.

H-4019. Rubber Cloth Factory. Coating mixture was being poured into pan which communicates with trough in "dope" machine by pipe. Difference between the "dope" machine and the "spreader" is that in "dope" machine cloth runs over a roller which revolves in mixture in trough, while in "spreader" mixture runs directly onto upper surface of stretched cloth and is spread out by cloth passing under knife edge. Hazard in both cases is the same. Rubber mixture contains large amount of naphtha, and sparks from static electricity are quite liable to occur.

Dope machine had just been started up. Spark of static electricity set fire to naphtha vapor from coating mixture, which spread fire rapidly.

H-4042. Cooperage. Fire occurred in cooperage and was caused by live coals left in barrel heater in shop over night.

H-4137. Canning Factory. Fire occurred at gasolene gas soldering machine. Leak in gasolene gas pipes allowed vapor to escape, which ignited and caused explosion. Plant is operated only during the canning season, which is limited to about six weeks during the year.

All gasolene pipes should be tested before beginning operations.

H-4154. Garage. Employee attempted to fill gasolene tank in an automobile inside of garage while the engine in automobile was running. Gasolene vapors ignited and set fire to automobile.

H-4200. Copper Works. Fire occurred at roof passage of inside steel stack from fuel oil heating furnace which had recently been started up. Stack said to have had one inch clearance. Roof ignited and fire spread to adjoining buildings.

Steel stacks should have at least a twelve-inch clearance from all woodwork. Stacks from cupola should have at least a three-foot clearance.

H-4203. Foundry. Fire started in an old wooden sill which was buried under ground behind a battery of brass furnaces. There were ten inches of fire brick and cement between fire and sill. Fire had evidently been smoldering for several days, as furnaces had not been used for two days before the fire. Fire spread up a wall, entering upper story.

All woodwork and combustible material should be removed from around furnaces.

H-4204. Varnish Works. Explosion of naphtha vapors. Fire occurred in the reducing and thinning room, in a small detached brick building; caused by employee thinning varnish. Varnish kettles are wheeled into this room and thinned with naphtha. Naphtha was apparently allowed to run too rapidly into the hot varnish and not sufficiently stirred. What ignited naphtha vapors is unknown.

H-4205. Garage. Fire occurred while cleaning the machinery of an auto with benzine. A bystander looking on struck a match to light a cigarette and dropped the match near the vessel, igniting the benzine.

H-4208. Paper Mill. Fire originated from hot box on beater engine and spread into "broke" and sulphite pulp on same floor. Mill men allow loose paper and imperfect sheets to pile up, and this they call "broke." A spark from a friction clutch into this "broke" caused a $30,000 fire a few years ago, and in incident quoted loss amounted to approximately $7,000. "Broke" is considered a very severe hazard of the paper mill.

S-8586. Rubber Works. Strips of rubber are run through a machine which braids cotton yarn on to them, after which they are put into a trough containing cement and then hung over the trough to drain. This trough is of galvanized iron, about ten feet long, one and one half feet wide and eight inches deep, and at the time of the fire contained a gallon or two of cement, composed of rubber and gasolene. A boy drew half a dozen or so of the braided strips from a pile on the floor and placed them in the trough when the contents immediately ignited, probably from static electricity. The fire burned the woodwork over and under the trough and ran up a post to the ceiling. The employees used sand, but as the fire caused considerable smoke, the steam pump was started and two large streams used. Twenty-one sprinklers in the room opened. The fire passed through the floor around a post and one sprinkler in the floor below opened and one hose stream was used, the fire being quickly extinguished.

S-8607. Woolen Mill. Fire occurred in lumper picker while picking shoddy, causing a flash fire in gauze room. Fire probably would have been confined to gauze room had doors at openings to this room been closed during time stock was being blown into room from lumper picker.

S-8657. Cotton Mill. Fire was first seen in the Buckley opener and hopper and on the distributing apron near the condenser. The fire ran along the distributing apron and dropped into the feed boxes of the other seven hoppers, setting fire to the cotton in the hoppers and damaging the aprons.

S-8703. Shirt Factory. Fire occurred at forming machine; caused by employee leaving the gas stove burning, which was used to heat forming machine. Stove over-heated and gas tubing burned off and ignited wall.

S-8726. Shoe Shop. Employee moving rack containing shoes freshly filled with cork and rubber cement. Castor of rack passed over a snap match on floor, igniting naphtha fumes.

S-8741. Department Store. Fire occurred in kitchen, restaurant section of department store, caused by a kettle of fat, in which potatoes are fried, being left on the stove and in some way ignited. Fire occurred at night when kitchen was not in operation. A small gas meter, hung by lead pipes, about ten feet from the origin of the fire, was disconnected by the heat and the escaping gas added materially to the fire. This meter is to be removed to a safe location.

S-8742. Manufacturing Cereals. Fire occurred in dry room by heated steam pipes. Dry room was used for drying wheat. Wooden trays which hold the wheat are set directly on the steam pipes and probably ignited from same.

S-8782. Metal Button Factory. Employee japanning buttons in a gas oven allowed the oven to become over-heated, thereby igniting the coating on the buttons, causing a heavy, dense smoke.

S-8791. Automobile Factory. Employee used gasolene to clean automobile parts before starting out with machine. He then used a match to light the lamps on machine, igniting the gasolene vapors.

S-8816. Flour Mill. Dust explosion occurred in a wooden, dust-settling, screw-conveyor trunk on third floor, just after starting machinery in the morning. Cause of explosion is unknown. Force of explosion was sufficient to open trunk at joints.

S-8831. Shoe Factory. Shoe tips, after being perforated, are singed over a gas flame to give the leather a clean edge, after which they are dipped in naphtha dye to give edge the desired color. Foreman states it is the custom to complete singeing process and turn off gas before dipping is started, but this day, after a lot of tips had been dipped and were lying on the table near where the singeing is done, a rush order came in to be singed. The young boy operating this department, not realizing the hazard, lighted the gas jet, which set fire to the shoe tips nearby.

Only competent workmen should be allowed to carry on hazardous processing, and under no conditions should it be entrusted to one who does not understand the hazards.

Common Causes.

H-4144. Woodworker. Fire occurred in shaving room. Caused by spark from boiler stack falling into shaving room through open door. Shaving room door should be arranged to close automatically.

H-4211. Dry Goods Store. Kerosene oil lamp, used as night lamp, was located in center of room on desk with goods piled all around. Lamp probably exploded, igniting combustible material.

S-8584. Cotton Mill. The insulation on the cord of a portable lamp, which had been hung over a nail in one of the loose cotton storage bins, became broken, and a short circuit between the conductors resulted. The cord was not of the reinforced type. The arc set fire to the lint on the board partition, which quickly spread to the cotton.

This fire again emphasizes the fact that plain cord should not be used in connection with portable lamps or where it is liable to be looped over nails or brought in contact with nearby objects. It is only suitable for use where allowed to hang free in air and then only where the occupancy of the room is not of an extra hazardous nature. For portable lamps, or where liable to be brought in contact with nearby objects, approved cord of the reinforced type should be used.

S-8743. Shoe Factory. Fire caused by smoking. A match was thrown into waste basket under desk. Waste basket was ignited and desk, curtain and side walls somewhat burned.

POINTS OF INTEREST FROM FIRE REPORTS.

Alarm Service.

S-8559. Watchman made his last round at 6 A. M., and at 6.55 A. M. sprinkler alarm connected to outside rotary gong operated. Employees were arriving to begin work, and extinguished fire.

Watchman service should be extended to cover all portions of the risk until the arrival of employees or day watchman.

S-8597. Alarm was sent to fire department by thermostats, three of which operated. Water was turned off the sprinkler system about six minutes later, or as soon as the fire department got to the fire.

S-8630. Watchman makes rounds every hour up through the hallways of the various buildings, and must necessarily consume some time on the trip. There is only one watchman in entire building, and he makes his headquarters in basement of building in which fire occurred. He had just completed a round, and had come from another section of building and descended into basement, when he found water pouring down the rear elevator shaft.

Had there been an additional watchman stationed in basement near annunciator from sprinkler alarms, the fact that sprinklers were in operation would have been discovered promptly, and much of the water loss averted.

S-8811. No water-flow alarm was received at central office from plant equipped with central station sprinkler supervisory service, but sprinkler gong on outside of building operated promptly. The failure of the flow alarm was probably due to corrosion or other trouble with the contact points of the alarm valve.

It is recommended that all supervised dry systems be equipped with a test pipe and valve, tapped into riser below air valve, and connected to flow alarm. If this were done, the flow alarm could be tested by the central office men when making their regular inspections.

S-8823. Watchman heard sprinkler operate while coming downstairs from second to first floor. Seeing that there was a fire, he turned in alarm from an auxiliary box in the building. The alarm was properly transmitted, and fire department arrived in a few minutes.

Automatic Sprinklers.

S-8806. The sprinkler equipment was being installed by the sprinkler company, and was practically ready for approval, although it had not been finally inspected when fire occurred.

The fire started in a pile of bones on top of open steam coils, simply scorching the ceiling. One sprinkler opened and practically extinguished the fire. The water damage amounted to practically nothing, as the bones are not subject to injury by water. The sprinkler concern deserves credit for keeping the equipment in commission before turning it over to the assured as complete.

S-8820. Fire occurred in basement, and smoke prevented fire department from getting into same. Two sprinklers opened, and entirely extinguished fire. Basement contained two bales of waste which had just been run through waste picker, making this a good sprinkler control.

S-8838. Fire occurred in boiler room, caused by a back draft from boiler. Fire spread from here to basement and first story, opening the four sprinklers in basement and one on first floor. There was one head in boiler room, and this did not open. After the fire it was found that this was a 300 degree head, and has been replaced by one of 165 degrees.

Chemical Extinguishers.

S-8825. Fire occurred in the top of a dry room used for the drying of shoe counters. It was located where same could not be reached by water from fire pails. When discovered by employee, fire had just started, and was extinguished by the chemical extinguishers before sprinklers opened.

Construction.

H-4237. The older portion of a plant had been built upon and enlarged so that some of it was four stories high above basement. There were no fire walls, and quite a large portion of the older part had been used as leather dry rooms, some portions having only single floors. That being the condition of the building, after the fire started it spread very rapidly, and building and contents were practically a total loss.

S-8663. Floors of the section where fire occurred are eight inches thick and scuppered, and the employees quickly swept the water from sprinklers down the elevator shaft so that none leaked through into floor below.

S-8731. Picker room of mattress factory is located in a corner of the top floor, so that two sides are the exterior walls of the building and are brick. The two inside walls are of terra cotta blocks, well laid. The windows in the exterior walls are of wire glass with metal frames. The picker machines are located close to the terra cotta walls, and have the feeding apron projecting through a hole in the wall, so that the man feeding the machine is not in the picker room. This opening has an iron drop to shut off the opening.

At the time of the fire the floor was tin clad. Since the fire

another thickness of tin has been added on top of the old one, with the joints soldered and tinned up at the edges about a foot. This makes a pan about a foot deep, which would prevent water damage on the floor below.

S-8783. Fire occurred in sub-basement in fireproof waste paper vault. This vault was equipped with automatic tin clad fire doors, also metal clad doors on each floor in chute connected with vault. These were closed when fire occurred, and there was no smoke or fire outside the vault or chute. Three sprinklers opened and practically extinguished fire.

Fire Doors.

H-4057. Mill was a six-story structure with a four-story warehouse addition equal to three of the mill stories in height, cut off by double tin clad fire doors. Floor of mill was held by release plates and falling floors and roof tore all fire doors on mill side from hangers, leaving only those on warehouse side. These fire doors held fire in check and prevented same from spreading into warehouse through the wall openings.

Fire Wall.

H-4068. Parapeted fire walls separated the burned building and adjoining one, and together with fire doors at openings in same prevented what might have been a very serious fire. Fire doors did excellent work.

H-4098. Fire wall through plant kept fire from spreading into rooms on the west side. Fire wall was heavy, constructed of stone.

Fire Pails.

S-8794. Fire caused by overheating of a small fitting on carpet loom ignited fly, and blazing up into loom, struck the cotton warp, which runs horizontally at this point, and burned the warp away from the cloth and also burned some of the spools of woolen yarn above.

Superintendent happened to be standing near and quickly grabbed a fire pail and threw the contents on fire. The employees used about six pails more which extinguished fire. No sprinklers opened.

Floor Openings.

H-4065. Fire spread through an open stairway from basement to second floor. Stairways were not enclosed or trapped.

H-4130. Fire started in basement and spread up to roof through elevator shaft. Elevator shaft was not enclosed.

Gate Valves.

S-8592. One sprinkler opened and entirely extinguished fire. The water could have been shut off immediately at arrival of fire department and much of the water damage saved if the firemen had known the location of gate valve controlling this section. Instead they went to first floor and spent some time in locating main valve, then went to the tower over the top floor and shut off the tank supply, putting whole system out of service.

Hose and Standpipe.

H-4196. Watchman tried to extinguish fire by the use of the 2-inch hose connection in the boiler room which was supplied by a 2,500 gallon gravity tank, but found no water, the tank being empty. He then endeavored to extinguish fire with water pails, but was unsuccessful.

Private protection should be inspected frequently and kept in the best of condition.

S-8742. Sprinklers did not open, as fire was extinguished with standpipe hose before there was heat enough to operate sprinklers.

Obstruction to Distribution.

S-8771. Sprinklers were working at a disadvantage, as the fire originated and was burning on the side of the hall partition with the nearest sprinkler nine and one-half feet distant. A hole about one foot square had been cut through the partition opposite the hall sprinkler to allow water to throw through. This the sprinkler ineffectually did. Fire would undoubtedly have been promptly extinguished had there been a sprinkler on each side and near to the partition. Under these unfavorable conditions, the sprinklers were holding the fire in check, but it is doubtful if they could have extinguished it without aid.

S-8813. Fire started in a case of cloth clippings under a large cutting table on fifth floor, spread along the underside of table and partly burned two other cases of clippings. Probably caused by smoking. Water from sprinklers could not reach seat of fire, but successfully held it in check until fire department arrived.

All benches and tables over four feet wide by ten feet long should have a line of sprinklers underneath, even if set away from wall. This is of still greater importance if space under tables is used for storage or shafting.

Private Protection.

H-4005. Private protection consisted of an elevated wood tank of 25,000 gallons capacity at 63 feet elevation on steel tower. This was connected by a four-inch circulating main to six outside hydrants and standpipe system. The private fire protection was of no value in fighting the flames, as tank tower being subjected to severe heat soon buckled, allowing the tank to fall to earth.

Elevated tanks should be detached a safe distance from building exposures.

H-4146. Water supply for private protection was very poor. Private hose used from roof connection on foundry and from yard hydrant; also one stream from adjoining plant. All connections on same dead end six-inch mains. Public fire department responded quickly with steamer and hose wagon, but was handicapped by lack of water. Steamer sucked mains dry. Pressure improved after about an hour, and enabled department to save portion of the plant.

H-4162. Private yard hose supplied by a small tank practically over main building. This caught fire at the start, and was of no value. There was no fire department protection, and risk was a total loss.

S-8769. A hose house in the yard, with 250 feet of hose, was destroyed, as it adjoined the workhouse in which fire started. Better protection for private fire fighting apparatus desirable.

Hydrants and hose houses should be located preferably so that hose lengths of 100 to 150 feet are sufficient. On the other hand, hydrants should not be located too close to buildings. Forty to fifty feet distant is considered good practice with buildings of ordinary height.

Public Water Supply.

H-4017. Fire occurred during a moving picture show, from unknown cause. Fire department responded promptly, and apparently extinguished fire. Firemen shut off water, but did not report the fact to pumping station, the result of which was a broken main. Fire was not entirely extinguished as believed, and started up again. There was no pressure, on account of the broken main, and a bucket brigade saved adjoining buildings.

Waste Cans.

S-8459. Fire occurred in waste can. Bagging, which had been used as an apron, was pressed into top of can as a cover. Fire probably caused by spontaneous combustion.

Metal covers should be kept on metal waste cans at all times.

Wired Glass Windows.

H-3961. The office of the electric power station was adjacent to the exposed property which burned, but was separated from same by a blank wall. The end windows of office, however, were burned out, and fire penetrated same. The main power station was about 50 feet from the burning exposure. The windows on this wall were all protected by wired glass and metal frame windows. They show the effect of great heat, and every window is badly cracked. Not a piece of glass fell out, however, and the windows did their duty admirably, undoubtedly saving a large loss in the station.